

VOLVO

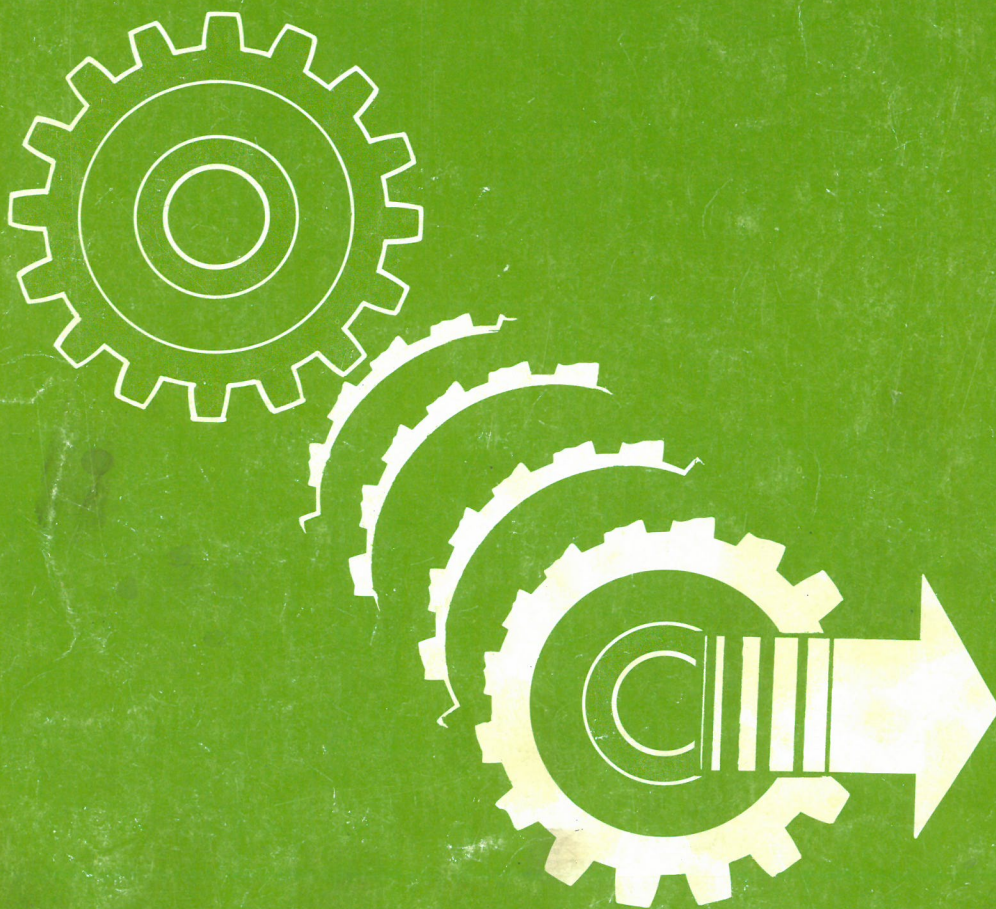
Service Manual

Reconditioning

Section 4 (43)

**Manual transmissions
M 46, M 47, M 47 II
including types J & P
Overdrives**

700



Volvo Car Corporation

10-10-1965

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Volvo Car Corporation

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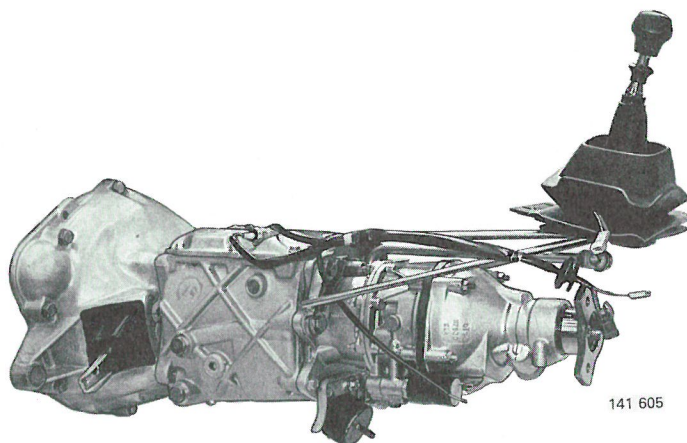
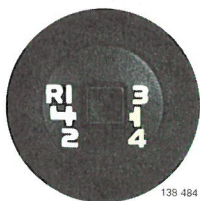
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Order number TP 30941/1

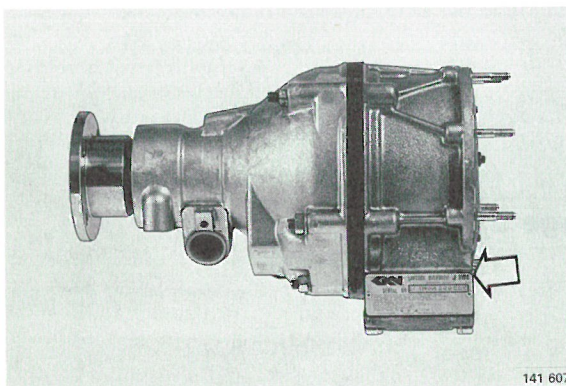
We reserve the right to make alteration without prior notification

Foreword

M 46 Transmission

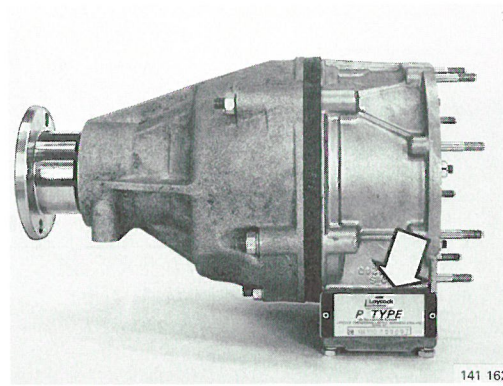


Four-speed transmission with electrically-operated overdrive. Transmission housing of cast iron or aluminium. There are two types of overdrive, Type J and Type P.



Type J

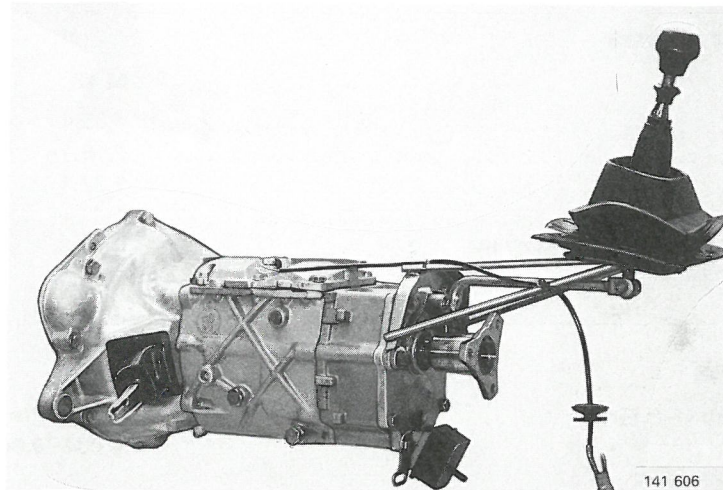
Overdrive is engaged by a solenoid which changes the oil flow direction. The gear ratio is changed by a planetary gear.



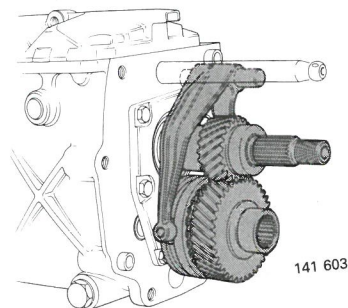
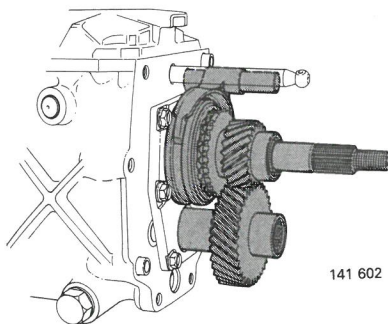
Type P

Stronger than Type J and is used in combination with high-torque engines. Has no connection for speedometer cable.

M 47/M 47 II Transmissions



Five-speed transmission with the fifth gear assembly located in the rear extension. From 1986, the fifth gear synchronizer and gear wheel are located on the countershaft (previously on the main shaft). Hence the designation M 47 II. Both types have aluminium housings.



M 47

An additional shaft incorporating a shift fork engages/disengages the fifth gear. The fifth gear synchronizer and gear wheel are located on the main shaft.

M 47 II

The fifth gear shift fork is extended to reach the synchronizer and gear wheel on the countershaft.

Specifications

Reduction ratios

	M 46	M 47/M 47 II
1st gear	4.03:1	4.03:1
2nd gear	2.16:1	2.16:1
3rd gear	1.37:1	1.37:1
4th gear	1:1	1:1
Overdrive (5th gear on M 47/M 47 II)	0.79:1	0.83:1 (M 47 II: 0.82:1)
Reverse	3.68:1	3.68:1

Clearances

Reverse gear to shift fork	0.1–1.0 mm 0.004–0.04 in	0.1–1.0 mm 0.004–0.04 in
End float: input shaft	0.01–0.20 mm 0.0004–0.008 in	0.01–0.20 mm 0.0004–0.008 in 0.01–0.10 mm
countershaft	clearance 0.03 mm (0.0012 in) for pre- tension 0.05 mm (0.002 in)	
main shaft	0.01–0.20 mm (0.0004–0.008 in)	0.01–0.20 mm (0.0004–0.008 in)
5th gear synchronizer hub		0.01–0.20 mm (M47 only) (0.0004–0.008 in)

Overdrive oil pressures

4th gear	approx 0.15 MPa (21 psi)
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Overdrive engaged

D 24 T, with asbestos-free friction linings	2.8–3.1 MPa (400–440 psi)
Gasoline turbo with asbestos-free friction linings	< 3.4 MPa (485 psi)
Gasoline turbo with old type friction linings	3.9–4.2 MPa (555–600 psi)
Remaining, with old type friction linings	3.7–4.0 MPa (525–570 psi)

Type P

All	2.8–3.1 MPa (400–440 psi)
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Lubricant

Type	*ATF type F or G
Oil capacity, M 46	2.3 litre (2.4 US qt)
M 47	1.3 litre (1.35 US qt)

* In case of complaints use Volvo Thermal Oil, P/N 1161243-3.
Volvo Thermal Oil should only be used for vehicles driven in areas
where the temperature seldom drops below -10°C (14°F) or for
high-mileage vehicles such as Taxis.

Tightening torques

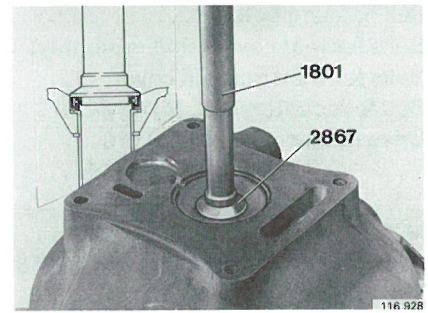
	Nm	ft lb
Bell housing bolts	35–50	25–35
Bolts for rear cover (shift assembly)	35–50	25–35
Bolts for transmission cover	15–25	10–20
Bolt for countershaft, M 47/M47 II	35–45	25–30
Drive flange nuts, M 47, M 16	70–90	50–65
M 20	90–110	65–80
M 46	165–180	120–135
Nut for rear housing M 46	12–18	9–13
Nut for 5th gear synchronizer, M 47 II	120	90

Overdrive

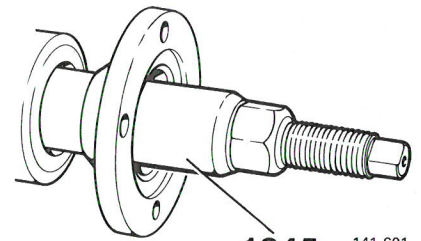
Plug for relief valve	22	16
Plug for filter	22	16
Plug for check valve	22	16
Oil pan bolts	10	7
Nuts on stud bolts, front housing	12	9
rear housing	12	9
Solenoid valve (solenoid)	50	40
Nuts for bearing holder	10	7
Plug, oil pressure gauge connection	15	11

Special tools

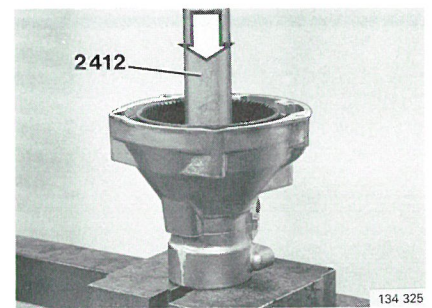
999	Description — use
1801-3	Standard handle: installing clutch housing seal
1845-0	Press tool: installing drive flange
2412-8	Drift: installing seal, bearing, output shaft in overdrive
2413-6	Drift: installing front bearing on M 47
2520-8	Stand: for fixture 5130
2709-7	Puller: removing overdrive
2806-1	Drift: installing bearing in holder for clutch unit
2834-3	Gauge: oil pressure
2835-0	Centering shaft: for planetary gear to output shaft
2836-8	Plug wrench: for plugs
2852-5	Support: installing synchronizer hub
2853-3	Support: removing synchronizer hub
2867-3	Drift: installing clutch housing seal
2985-3	Wrench: removing main shaft bearing
2986-1	Drift: installing countershaft bearing
5058-6	Puller: removing main shaft bearing
5064-4	Drift: installing seal in rear housing
5069-3	Puller: seal
5090-9	Tube: installing damper
5096-6	Spacer: 5th gear housing (B 28 tool, 4 pcs)
5103-0	Drift: removing bearing in holder for clutch unit
5130-3	Fixture: used with stand 2520 or 5154
5131-1	Puller: removing countershaft bearings
5154-7	Puller bolt: for 5058



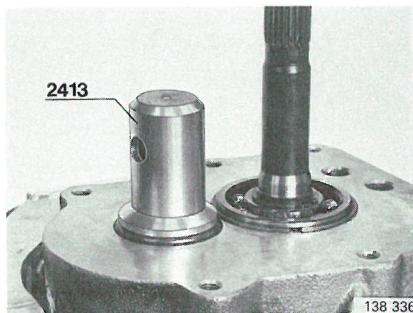
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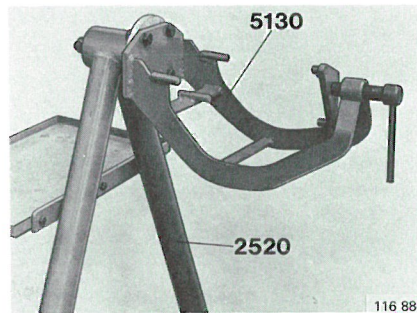
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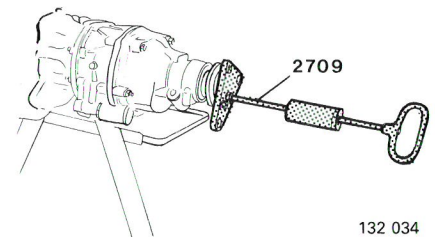
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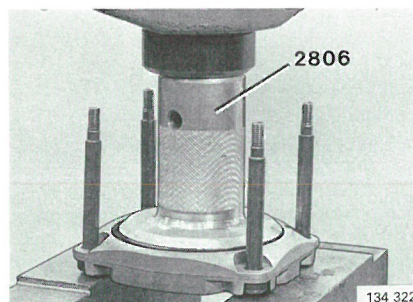
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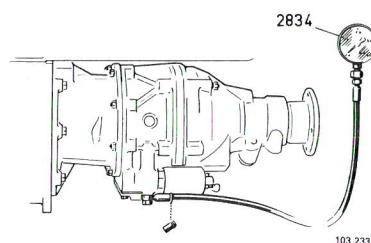
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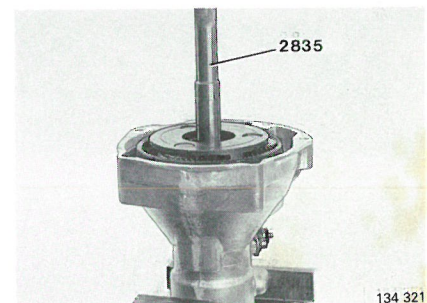
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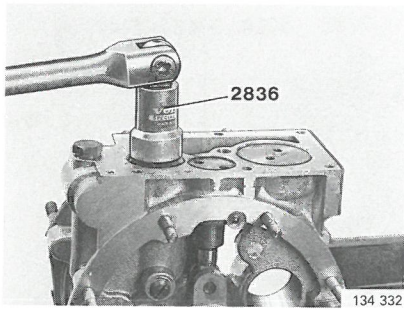
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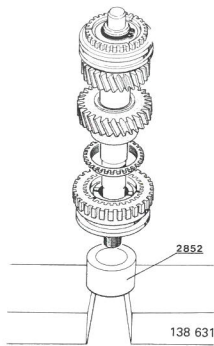


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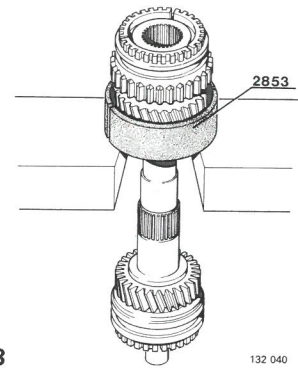
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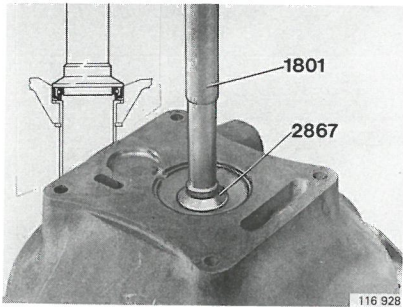
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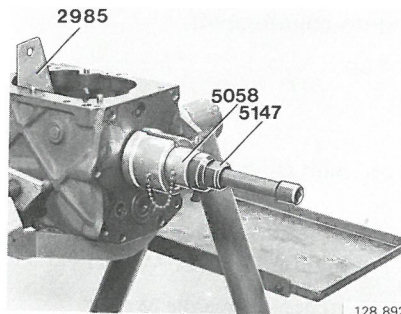
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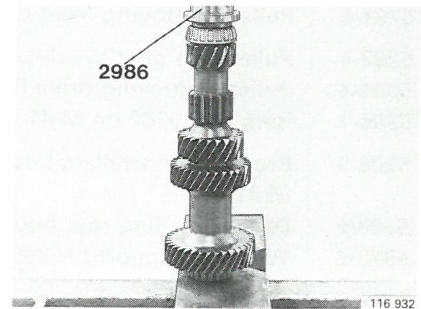
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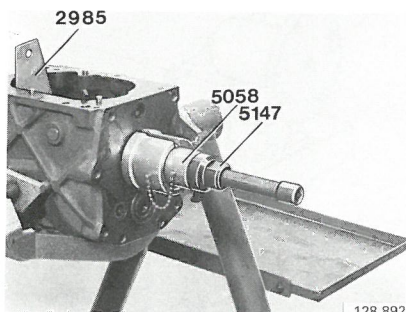
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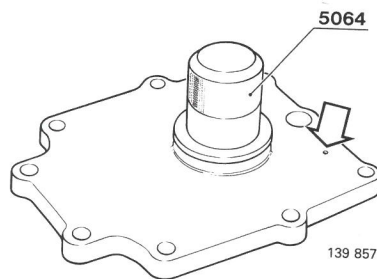
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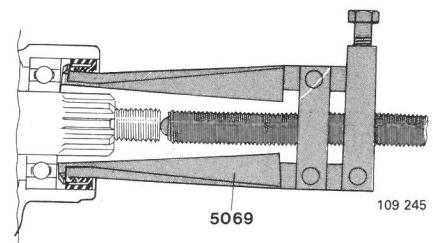
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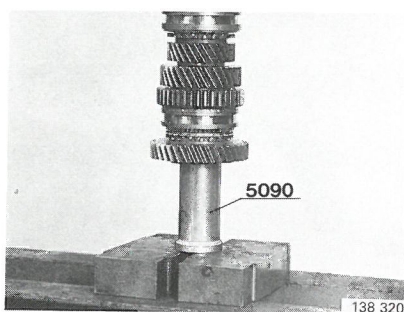
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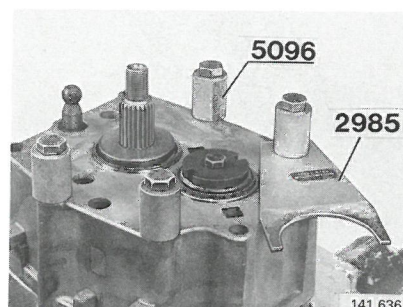
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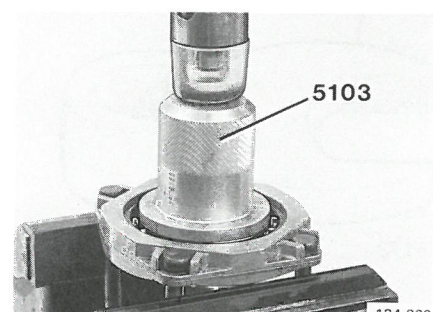
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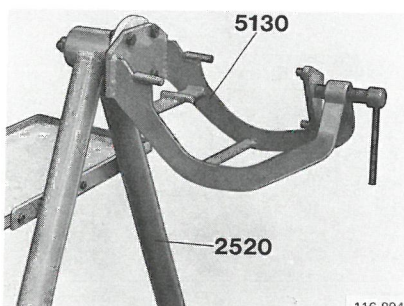
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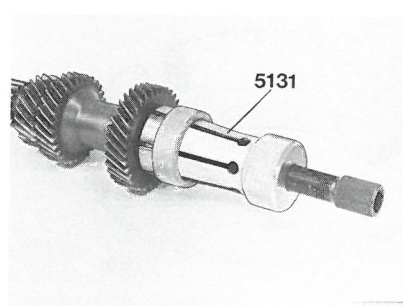
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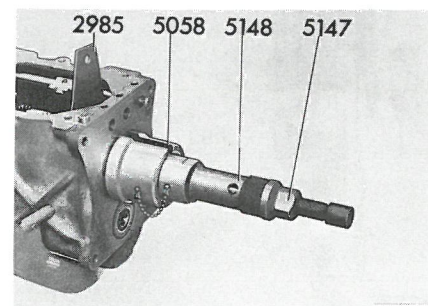
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5131

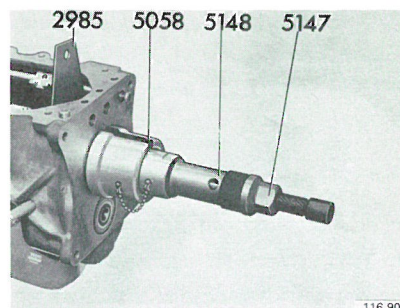
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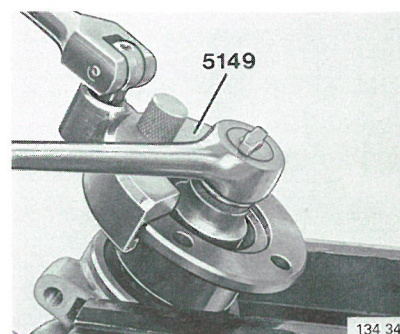
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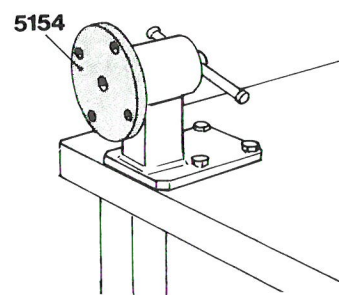
999	Description — use
5148-4	Extension for 5058 (2 pcs)
5149-3	Wrench: for round drive flange
5154-3	Bench attachment: for fixture 5130
5172-5	Crow foot wrench: for solenoid valve
5177-4	Puller: front bearing on countershaft, aluminium housing
5180-8	Drift: installing bearing on countershaft, aluminium housing
5183-2	Puller: for relief valve
5210-3	Ring: installing rollers in one-way clutch
5261-6	Puller: removing front bearing on countershaft
5262-4	Puller: 5th gear synchronizer hub
5304-4	Puller: removing drive flange
5305-1	Ring: for 5262 on M 47 II
5306-9	Press tool: installing bearing on main shaft and 5th gear M 47/ M 47 II
5308-5	Drift: installing rear housing seal, overdrive
5973-6	Washer: support for 998 7693 synchronizer/gear M 47 II
5986-0	Shaft: disassembling 5th gear synchronizer/gear M 47 II
998	
7693-0	Puller: removing 5th gear housing M 47/M 47 II
9177-0	Torque gauge: measuring damper torque



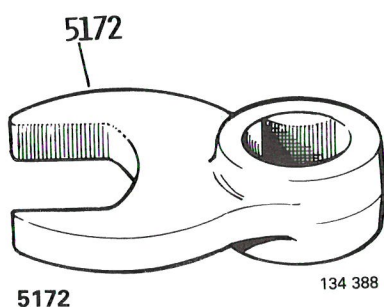
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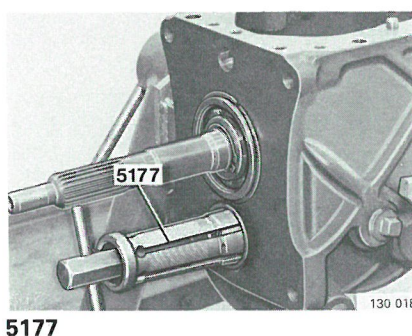
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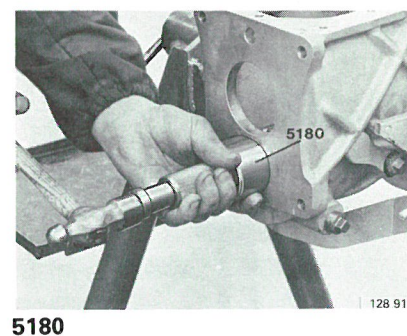
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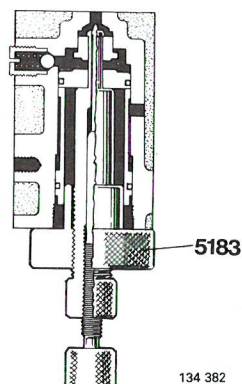
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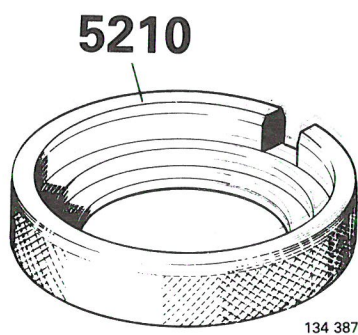
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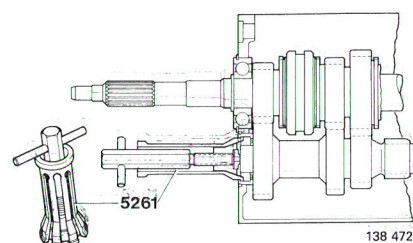
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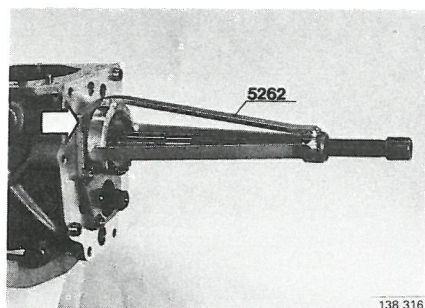
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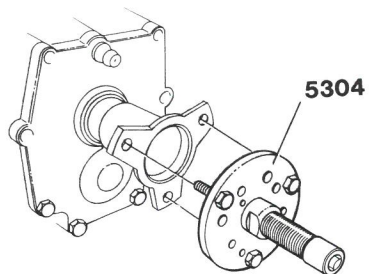


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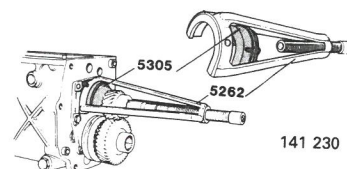
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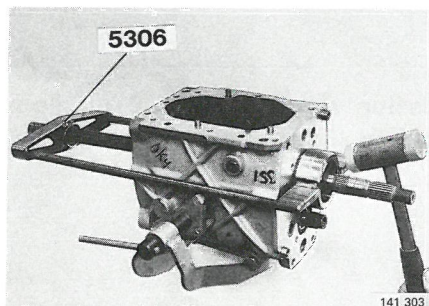
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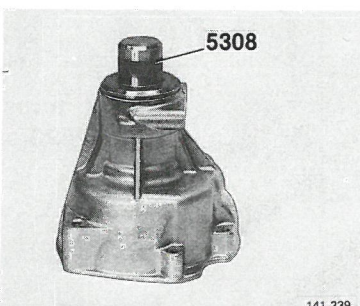
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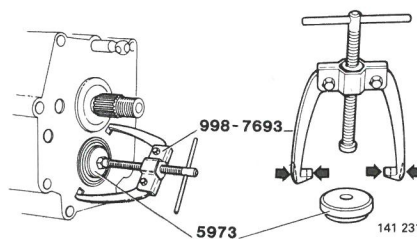
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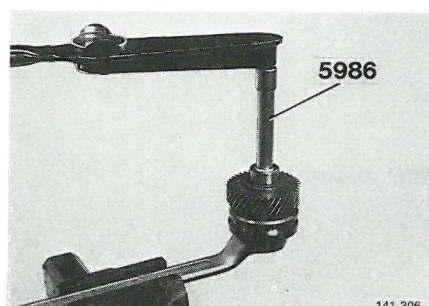
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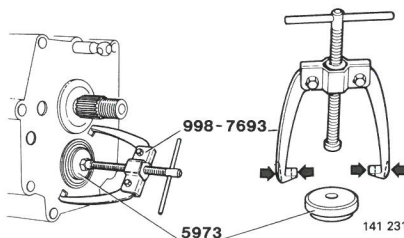
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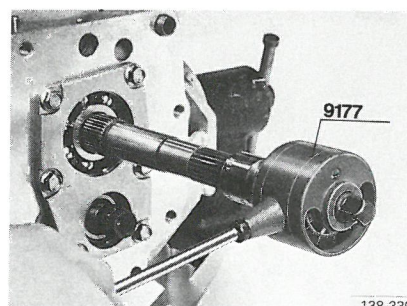
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998 7693

141 231

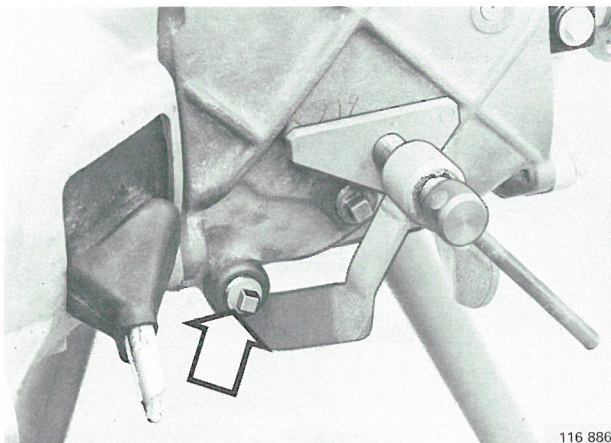


9177

138 330

A. Disassembling M 46

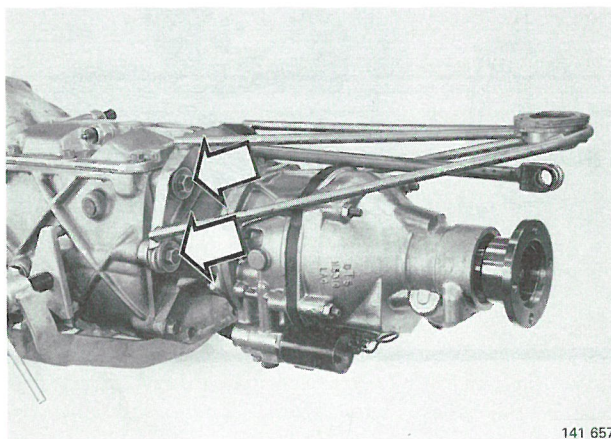
Special tools: 5130+2520 or 5154, 2709, 2853, 2985,
5058, 5131, 5147, 5148 (2 pcs), 5177



A1
**Mount transmission on fixture 5130 on floor
stand 2520 or bench support 5154**

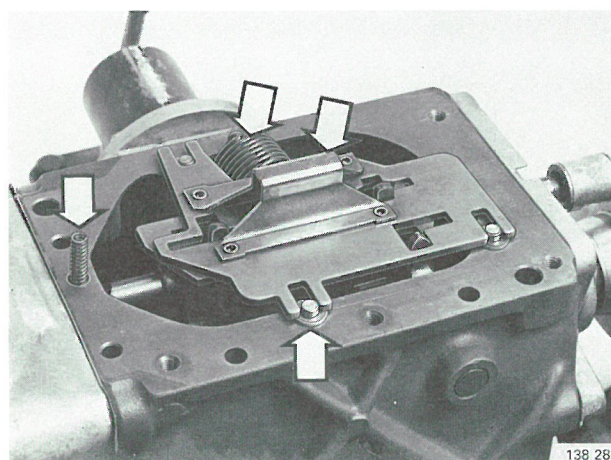
Drain oil

A2



Remove gear shift assembly

A3



Remove transmission cover and gasket

A4

Remove selector plate and return spring
Lift off washers, spring and ball.

A5

A6

Disconnect overdrive from intermediate housing

If required: use puller 2709

A7

Remove gear selector rod

Tap out both lock pins.

A8

Remove intermediate housing

Remove gasket.

Collect adjusting shims.

A9

Remove clutch fork and clutch release bearing

Save spacer washer.

A10

Remove clutch housing and gasket

Save adjusting shims.

Tap pipe rearwards to loosen seal. Some pipes have a lock ring, remove it first.

A11

Tap out lock pin (1)

A12

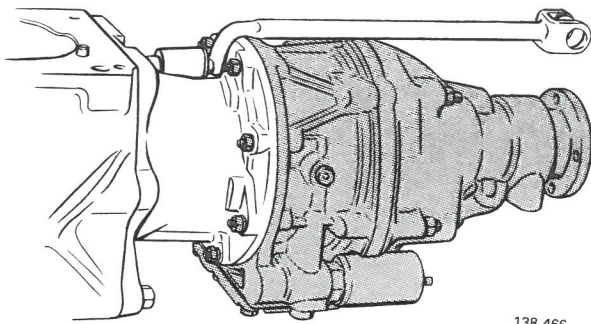
Remove selector shaft (2)

A13

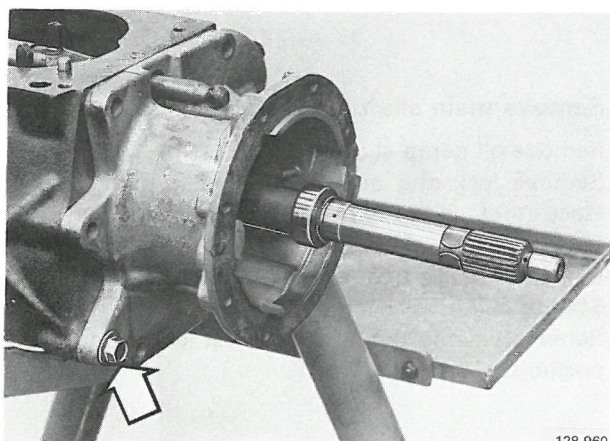
Remove shift forks (3)

A14

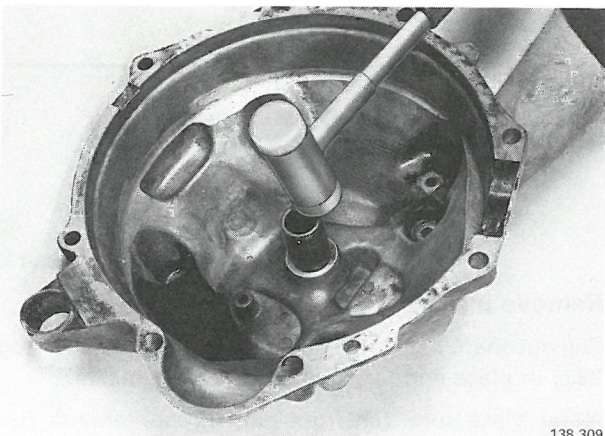
Remove selector shaft seal (4)



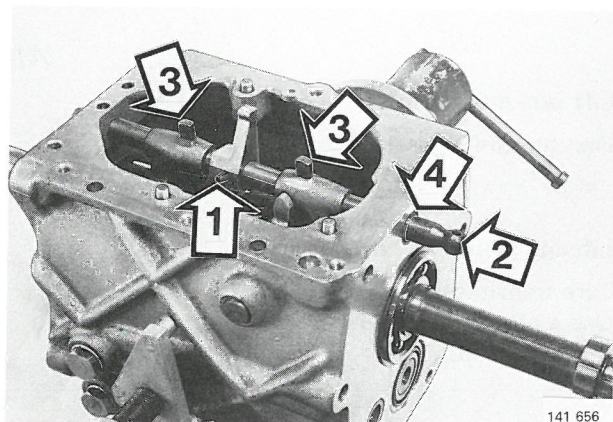
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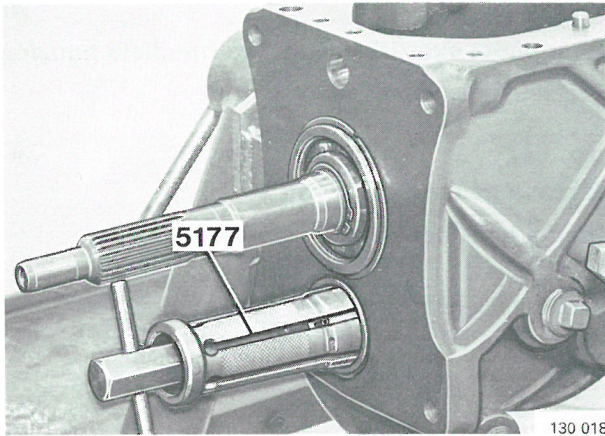
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138 309



141 656

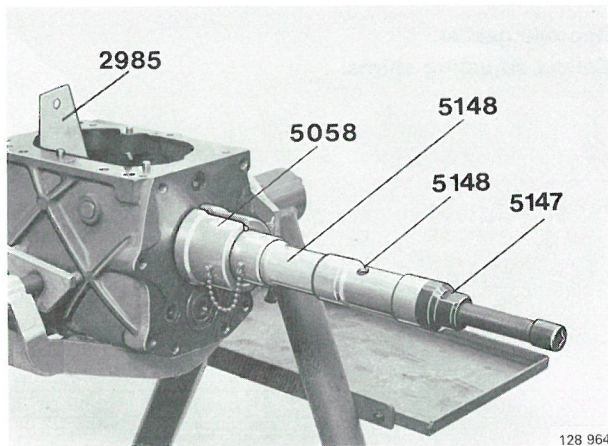


A15

Remove outer races for countershaft bearings

Transmission with aluminum housing:

Carefully tap shaft in both directions to enable puller 5177 to grip races.



A16

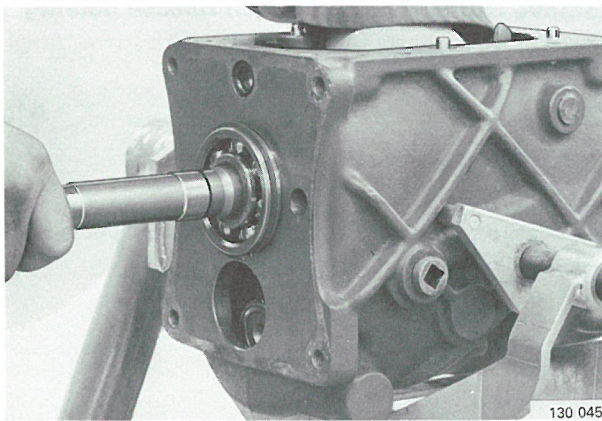
Remove main shaft bearings

Remove oil pump eccentric.

Remove lock ring and ring for main shaft bearing. Place tool 2985 between input shaft and front synchronizer.

Use puller 5058, two extensions 5148 and puller bolt 5147 to pull off bearing.

Remove bearing thrust washer but leave tool 2985 in position.



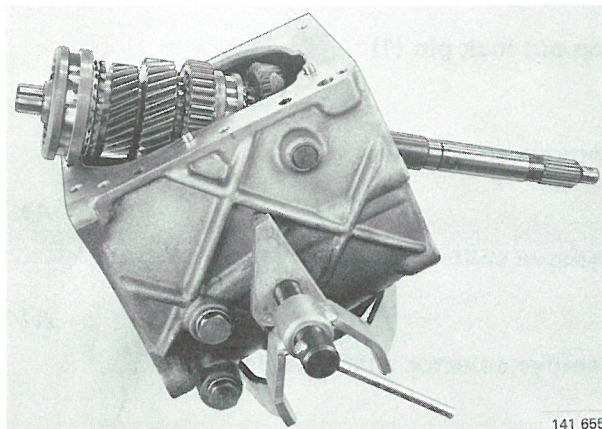
Removing all shafts

A17

Remove input shaft and synchronizer ring

Pull out shaft. If bearing sits tight in housing, leave tool 2985 in place and tap main shaft with a mallet.

Note! Make sure that front part of countershaft contacts bottom of housing.



A18

Lift out main shaft

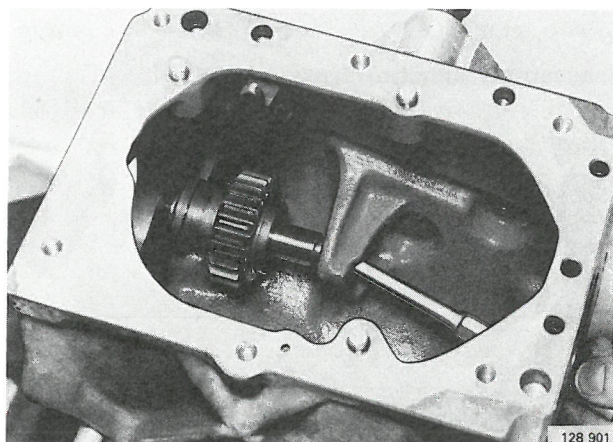
First turn transmission.

A19

Lift out countershaft

Turn transmission back.

Use a plastic mallet to tap out rear bearing race. Remove shaft.



128 901

A20

Remove reverse gear wheel and shaft

Use a drift to push shaft rearwards.

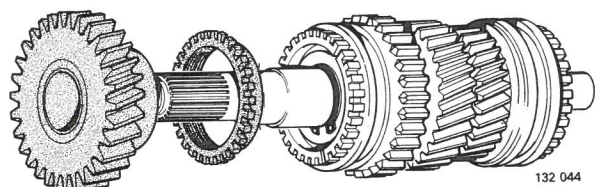
A21

Remove selector for reverse gear

Disassembling main shaft

Transmission equipped with damper:

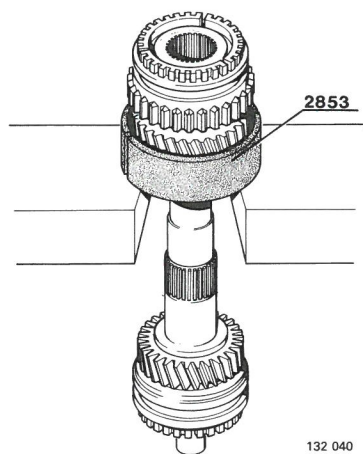
A22



132 044

**Press off washer, remove springs and brake ring.
Remove 1st gear with synchronizer ring.**

Remove lock ring for synchronizer hubs.

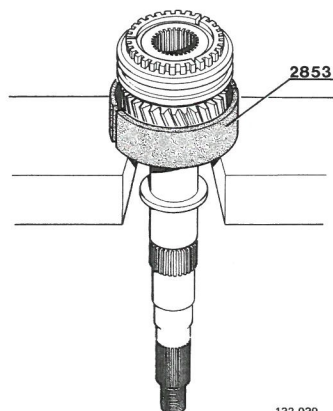


132 040

A23

Press off 1st—2nd synchronizer hub and 2nd gear wheel with synchronizer ring

Use support 2853.

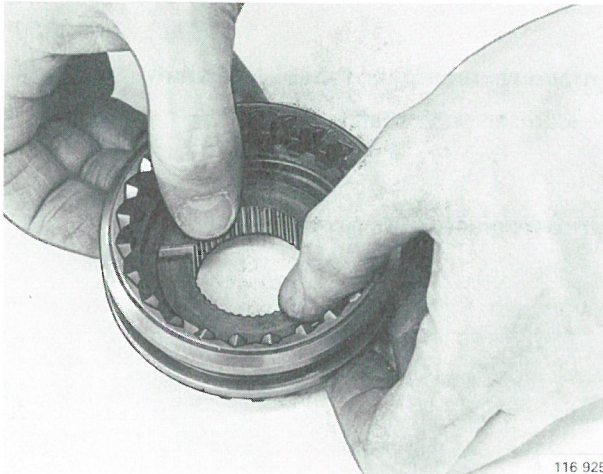


132 039

A24

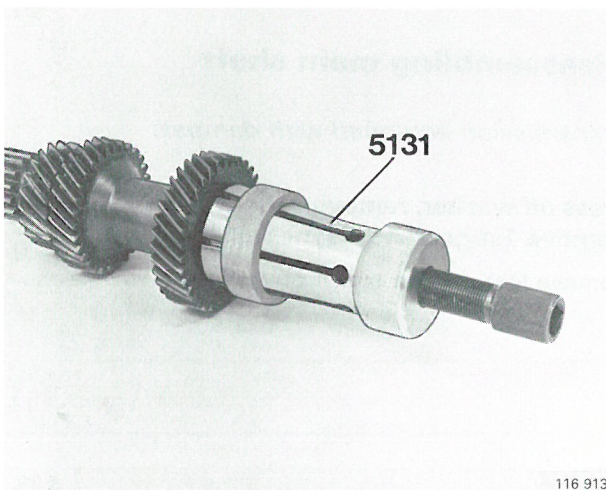
Press off 3rd—4th synchronizer hub and 3rd gear wheel

Use suport 2853.



Disassemble synchronizers

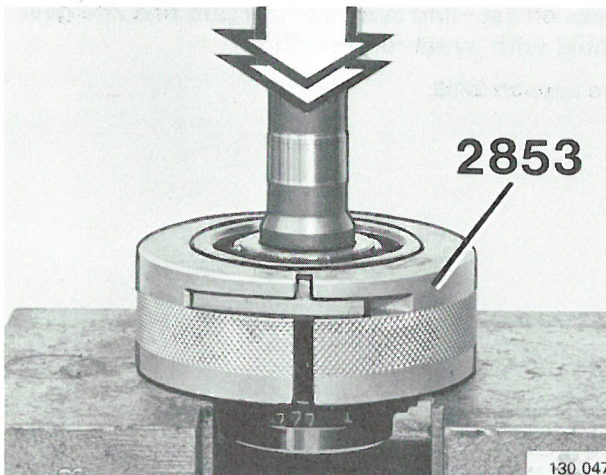
A25



Remove countershaft bearing

Use puller 5131.

A26



Remove input shaft bearing

Use support 2853.

A27

A28

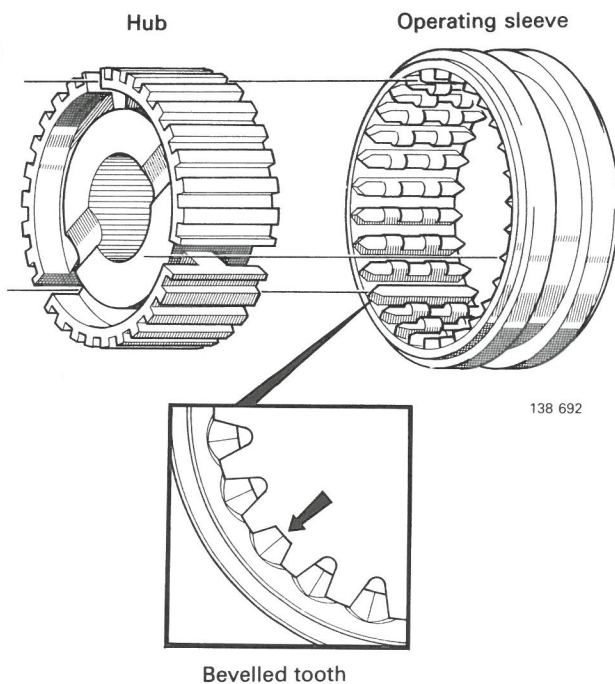
Clean and examine all parts

Wash all parts with solvent. Dry with compressed air.

Examine all parts. Replace worn or damaged parts and all seals and gaskets.

B. Assembling M 46

Special tools: 1801, 2852, 2853, 2867, 2986, 5090, 5180, 5306



Assembling main shaft

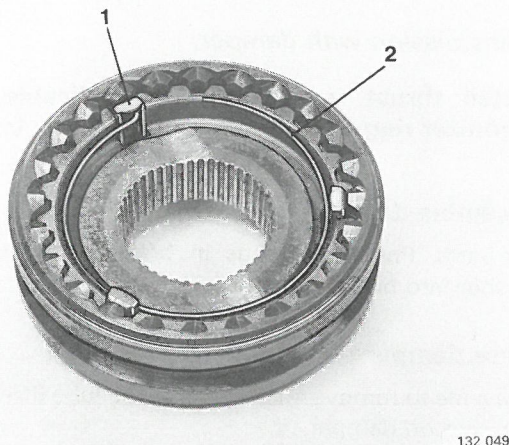
B1

Assemble both synchronizers

Place hub in operating sleeve.

3rd-4th gear synchronizer:

Three recesses in hub should align with the three bevelled teeth in operating sleeve.



B2

Install sliding keys (1) and springs (2)

Lock sliding keys ("dogs") with springs. Hook both springs to the same sliding key.

Install one spring counter-clockwise. Turn synchronizer over and install second spring, also counter-clockwise.

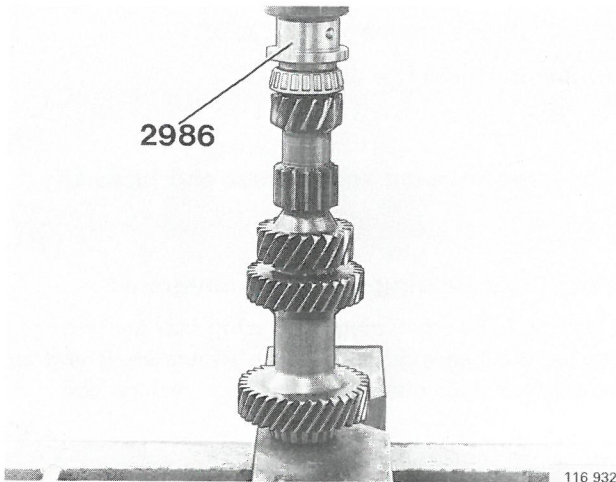
If spring is bent, free end must point away from hub.



Use support **2852**.

Use a file to remove sharp edges. Use tube **5090** when pressing on damper.

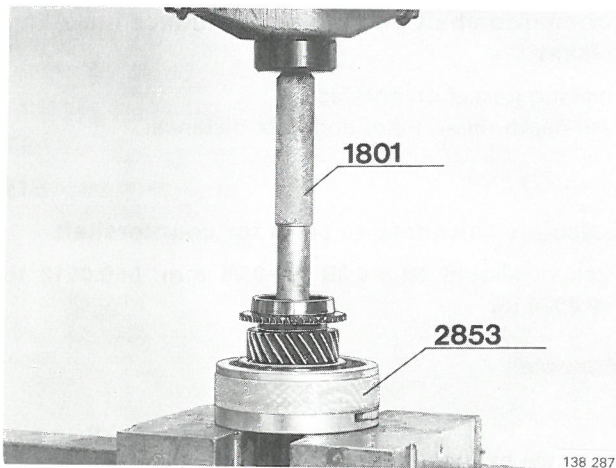
B10



Press both bearings on main shaft

Use drift **2986**.

Note! Two types of rear bearings. Check transmission serial number to see that correct bearing is used.



B11

Press bearing on input shaft

Use standard handle **1801** and support **2853**.

B12

Install lock ring on input shaft

For transmissions with cast iron housing: proceed to operation B22.

Operations B13–B21 only apply to transmissions with aluminium housing.

Determining thickness of countershaft shims

The countershaft should have a preload of 0.03–0.05 mm (0.0012–0.0020 in). If countershaft, countershaft bearing or rear end bearing was replaced, shim thickness must be determined.

Note! Apply assembly paste to aluminium surfaces prior to installing bearings and shafts.

Part Number 1 161 006-0 Aerosol
1 161 078-9 Can

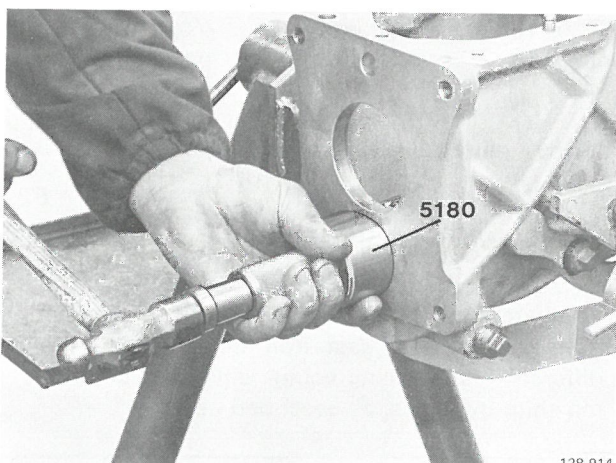
B13

Install countershaft in housing

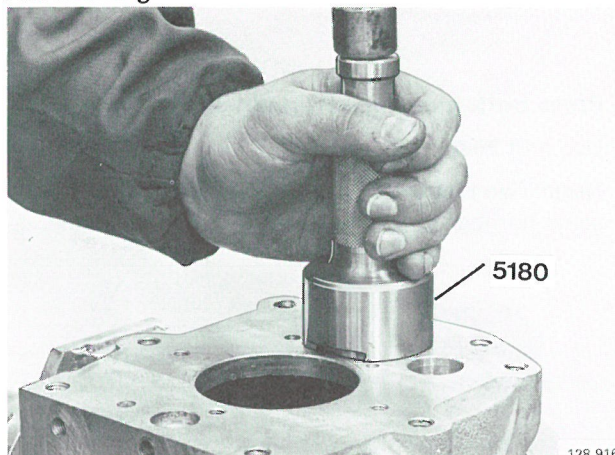
B14

Install front bearing race for countershaft

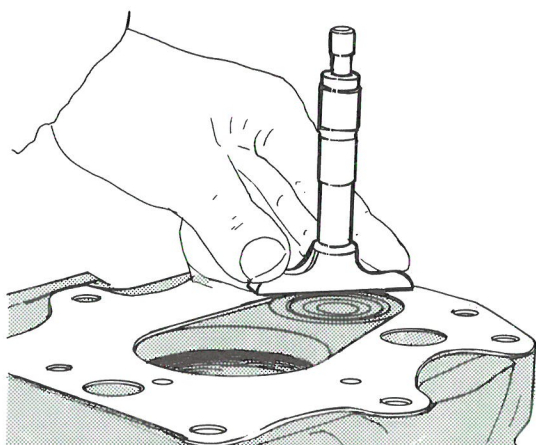
Use drift **5180** large end facing race. Let race protrude approx. 1 mm (0.04 in). It will take up correct position when installing clutch cover.



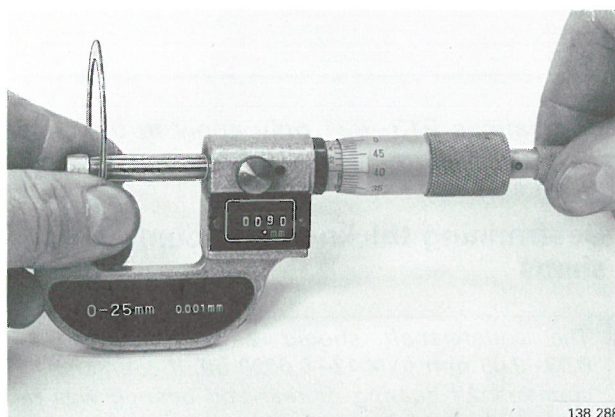
Assembling



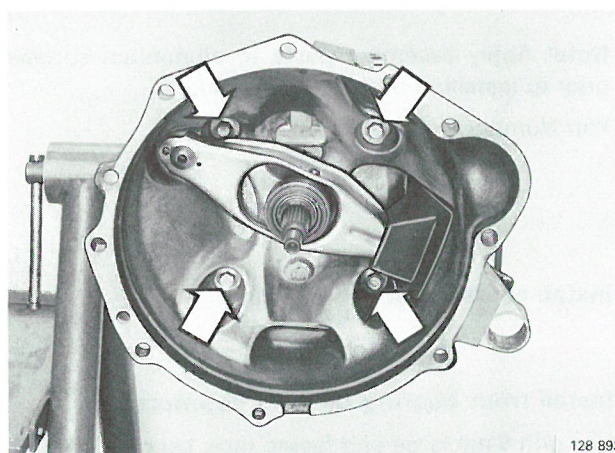
128 916



138 620



138 288



128 893

B15

Install clutch housing and gasket

Torque to 35–50 Nm (25–35 ft lb).

B16

Turn transmission so that rear end faces UP

B17

Install rear bearing race for countershaft

Use drift **5180** small diameter facing rear bearing race. Make sure bearing has no play. Rotate shaft and tap until there is no play (shaft has light resistance).

B18

Measure distance between outer bearing race for countershaft and housing end face including gasket

Position gasket on end face.
Use depth micrometer and note distance.

B19

Calculate thickness of shim for countershaft

Preload should be +0.03 to -0.05 mm. (+0.0012 to -0.0020 in)

Example:

	mm	in	mm	in
Distance bearing race to gasket face	1.79	0.0705	1.79	0.0705
Clearance/preload	-0.03	-0.0012	+0.05	+0.0020
	1.76	0.0693	1.84	0.0725

Choose shim 1.80 mm (0.0709 in). If possible, choose shim of thickness to obtain countershaft preload. Following shims are available:

P/N	mm	in
949048-3	0.05 mm	0.002 in
948298-5	0.10 mm	0.004 in
948299-3	0.15 mm	0.006 in
948300-9	0.35 mm	0.014 in
948301-7	0.50 mm	0.020 in
948302-5	0.70 mm	0.028 in
948303-3	1.00 mm	0.040 in

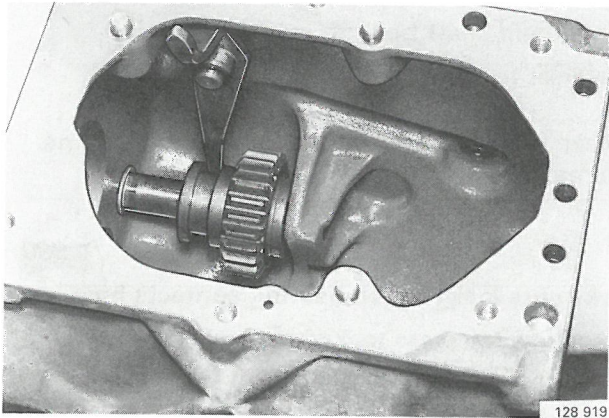
B20

Remove clutch cover and gasket

B21

Remove countershaft

Continue assembling transmission as described for transmission with cast iron housing. The only difference is installing countershaft and determining shim thickness, as described above.



Installing shafts in transmission housing

B22

Install gear selector for reverse gear

Install lock ring for shift fork.

B23

Install reverse gear wheel and shaft

B24

Check/adjust position of reverse gear shaft

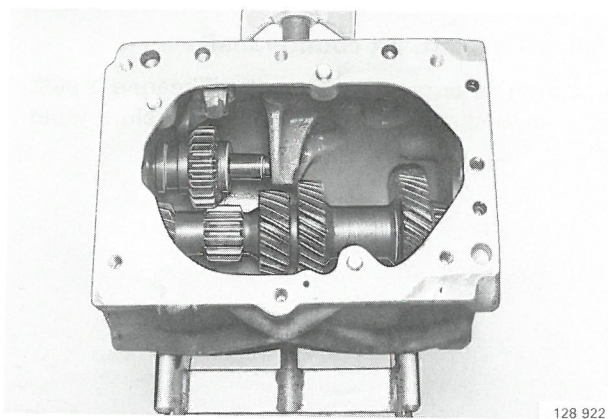
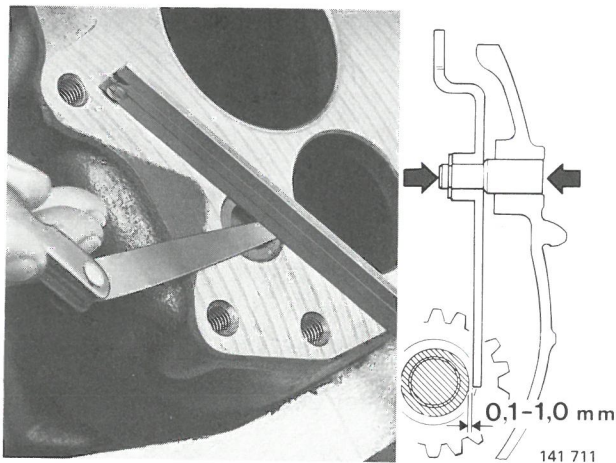
Shaft end should be flush with housing or max. 0.05 mm (0.002 in) inside housing face. See left.

B25

Check/adjust clearance between reverse gear wheel and shift fork

Adjust by tapping shift fork bearing stud, using a drift. See right illustration.

Correct clearance: 0.1–1.0 mm (0.004–0.040 in).



B26

Place countershaft in bottom of housing

B27

Place main shaft in housing

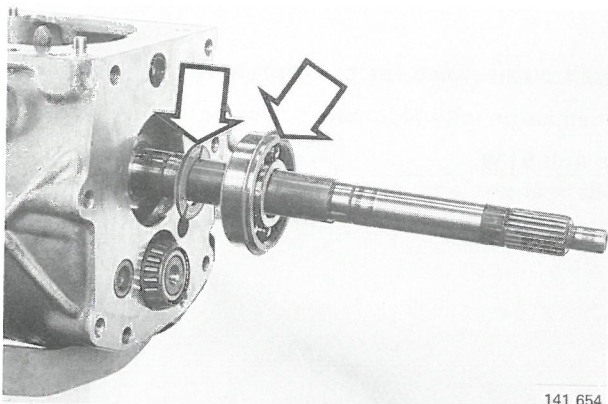
First turn housing

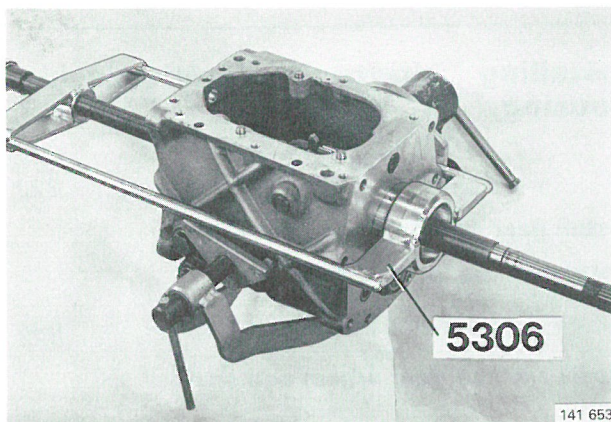
Installing main shaft rear bearing

B28

Install thrust washer (only transmissions without damper) and bearing with lock ring on main shaft

Countershaft should be positioned in bearings.





B29

Press main shaft bearing into position

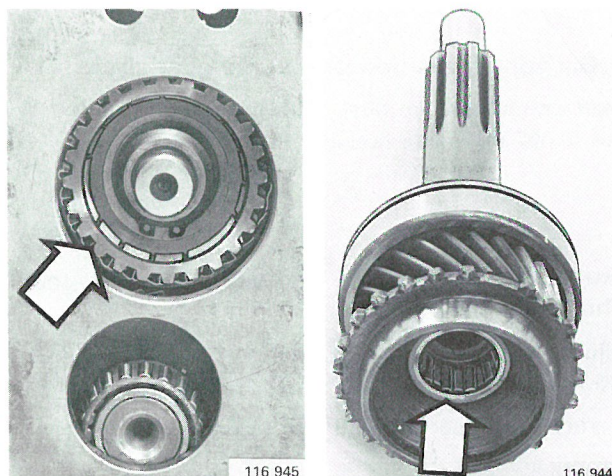
Use press tool 5306.

Make sure gear teeth do not clash and become damaged when pressing on bearing.

B30

Make sure lock ring on bearing contacts housing

If required, tap press tool with a mallet until bearing positions correctly.



Installing input shaft

B31

Position 4th gear synchronizer ring in synchronizer hub

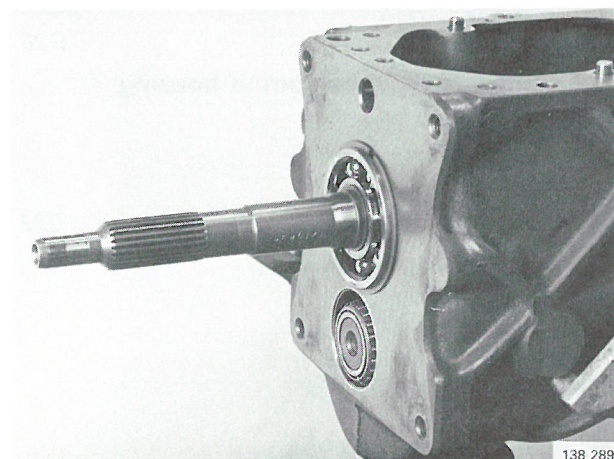
B32

Grease and install roller bearing in input shaft

B33

Install input shaft, lift countershaft

Tap bearing outer race with a mallet if bearing is stiff. Place countershaft bearings in position before input shaft.



B34

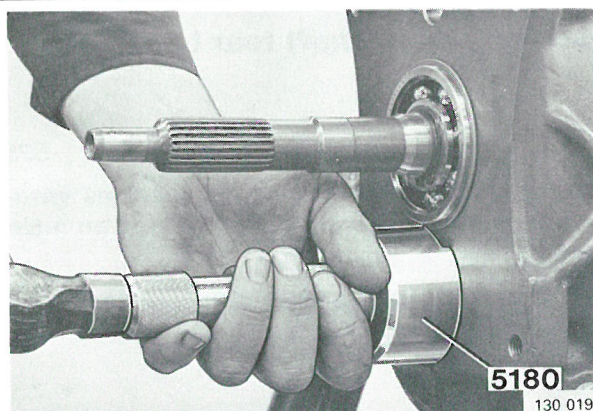
Install outer races for countershaft

Transmission with aluminium housing:

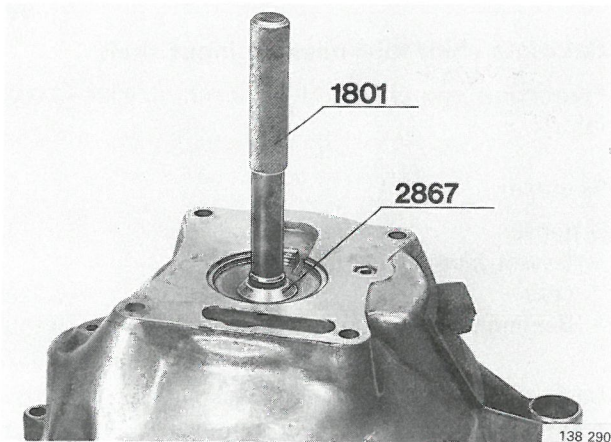
Use drift 5180.

Front bearing: large end of drift.

Rear bearing: small end of drift.



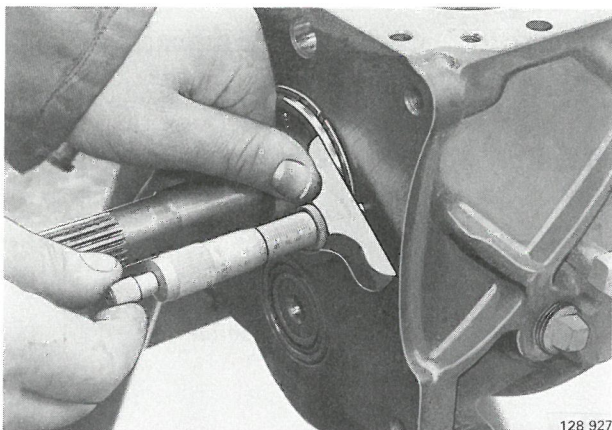
B35

**Grease and install seal in bell housing**

First check that tube bottoms.

Use drift **2687** and standard handle **1801**.**Determining thickness for shim on input shaft**

Input shaft should have an end clearance of 0.01–0.20 mm (0.0004–0.0080 in). If bearing on input shaft or bell housing was replaced, shim thickness must be determined.

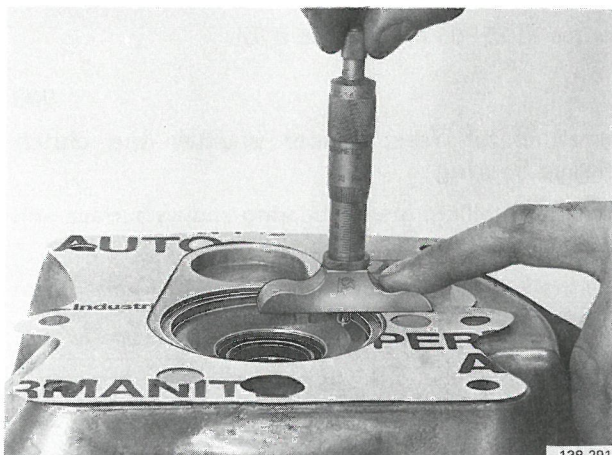


B36

Measure distance between outer face of input shaft bearing and front face of transmission

Make sure lock ring on bearing abuts housing.

Use depth micrometer and note reading.



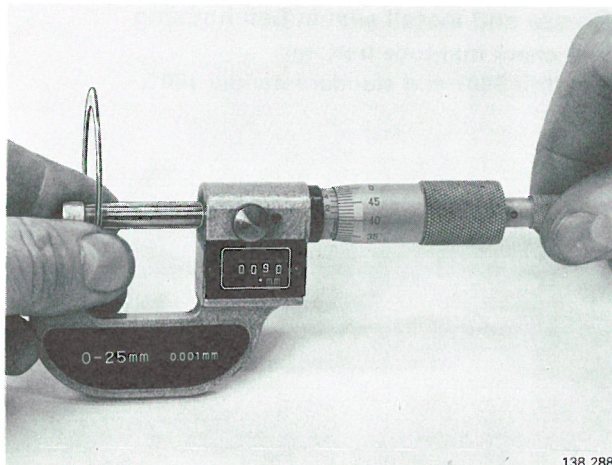
B37

Position gasket on clutch housing

B38

Measure distance between outside of gasket and bottom of bearing seat

Note reading.



138 288

Calculate shim thickness for input shaft

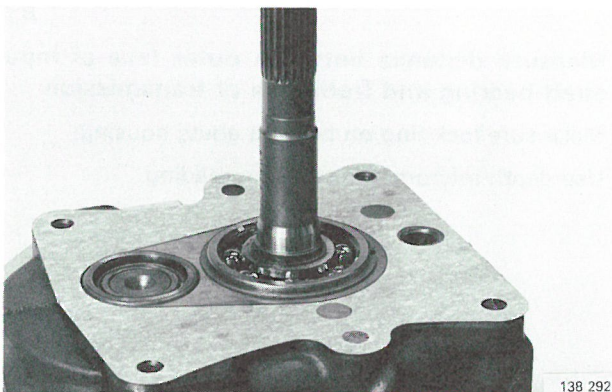
Permissible end play. 0.01–0.20 mm (0.0004–0.0080 in).

Example:

Distance:	mm	in
– Gasket face to bearing recess	5.80	0.2283
– Bearing to transm. housing	<u>–4.85</u>	<u>–0.1909</u>
	<u>=0.95</u>	<u>=0.0374</u>
Deduct end play	–0.01	–0.0004
	<u>to 0.20</u>	<u>to 0.0080</u>
Determined shim thickness:	<u>=0.75</u>	<u>=0.0294</u>
	<u>to 0.94</u>	<u>to 0.0370</u>
Select shim thickness	<u>0.90 mm</u>	<u>0.035 in</u>

Following shim thicknesses are available:

P/N	mm	in
3292838–4	0.25	0.010
948008–X	0.60	0.024
948009–6	0.75	0.030
948010–4	0.90	0.036
948011–2	1.00	0.040



138 292

Installing clutch housing ("bell housing")

B40

Grease transmission gasket face and install gasket

B41

Position shim in clutch housing

Apply grease to hold shim in position.

B42

Install clutch housing

Torque to 35–50 Nm (25–35 ft lb)

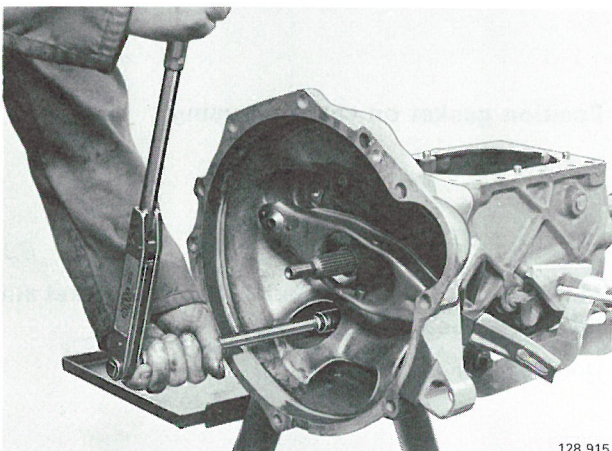
B43

Install clutch fork, spacer washer and clutch release bearing

Prior to installing, grease bearing sliding surface and ball joint.

Sparingly apply grease to splines. (Do not forget washer under ball joint.)

Transmissions with aluminium housing: proceed to operation B46.

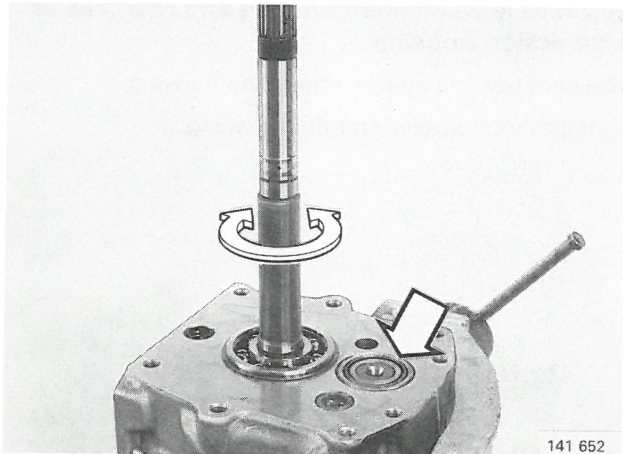


128 915

Operation B44–B45 only apply to transmissions with cast iron housings.

Determining thickness for shim on countershaft

End float should be 0.025–0.10 mm (0.001–0.004 in). If the countershaft, any of its bearings, or the rear case/intermediate housing have been replaced the shim thickness should be determined.

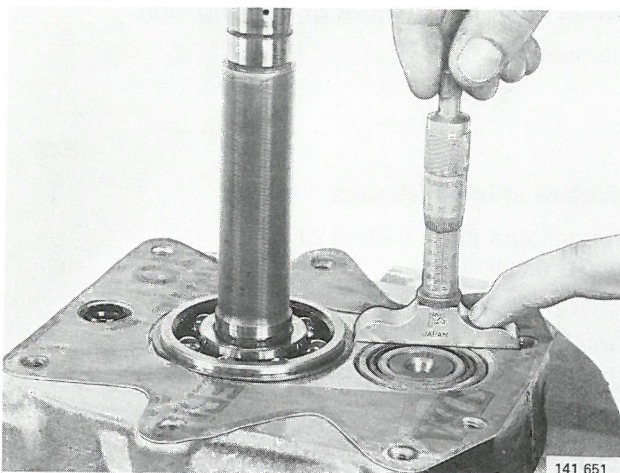


141 652

B44

Make sure bearing races are correctly positioned

Depress races while turning main shaft a couple of turns until bearing rollers have centered.



141 651

B45

Position gasket. Measure distance between countershaft outer bearing race and gasket face.

Use depth micrometer and note reading.

Example:	mm	in
Distance race to gasket face	1.68	0.0661
permitted end float	–0.025	–0.0001
	<u>to 0.10</u>	<u>to 0.0040</u>
	= 1.58	= 0.0660
	<u>to 1.655</u>	<u>to 0.0621</u>

Select shim thickness **1.65 mm**. (0.066 in)

Following shim thicknesses are available:

P/N	mm	in
949048–3	0.05	0.002
948298–5	0.10	0.004
948299–3	0.15	0.006
948300–9	0.35	0.014
948301–7	0.50	0.020
948302–5	0.70	0.028
948303–3	1.00	0.040

Determining thickness for shim on main shaft

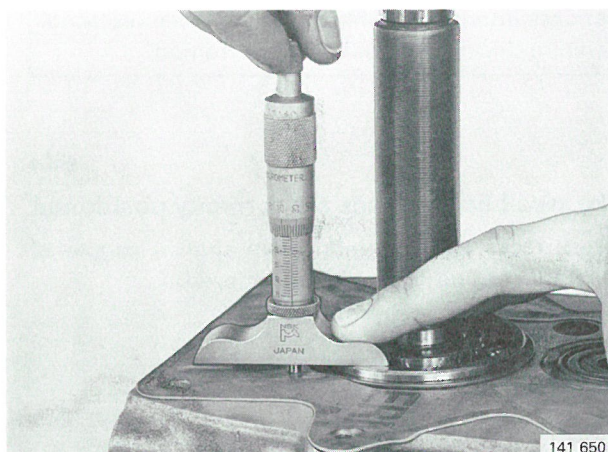
Main shaft end float should be 0.01–0.20 mm (0.0004–0.0080 in). If a main shft bearing or the intermediate section has been replaced or the shim thickness should be determined.

B46

Position gasket. Measure distance between outer face of main shaft bearing and rear face of transmission housing

Make sure bearing spacer ring abuts housing.

Use depth micrometer and note reading.

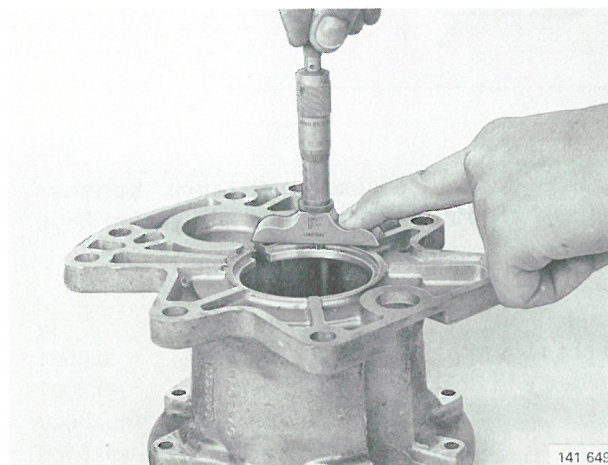


141 650

B47

Measure distance between intermediate section contact face and bottom of bearing seat

Note reading.



141 649

B48

Calculate shim thickness

Permitted end float: 0.01–0.20 mm (0.0004–0.0080 in).

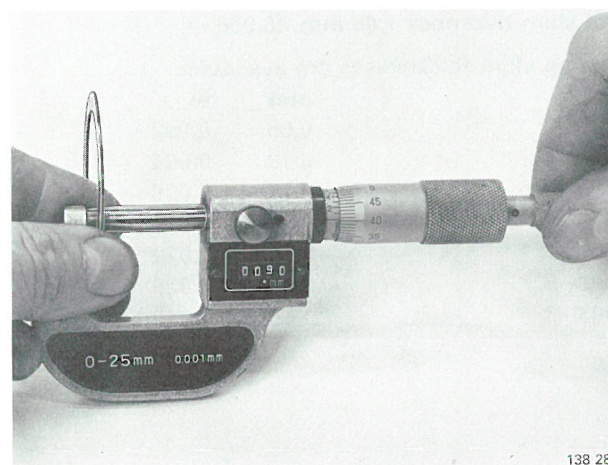
Example:

	mm	in
Distance:		
– Face to seat	5.50	0.2165
– Bearing to gasket face	–4.46	–0.1756
	<u>=1.04</u>	<u>=0.0409</u>
Deduct end float	–0.01	–0.0004
	<u>to 0.20</u>	<u>to 0.0329</u>
	to 0.84	to 0.0405

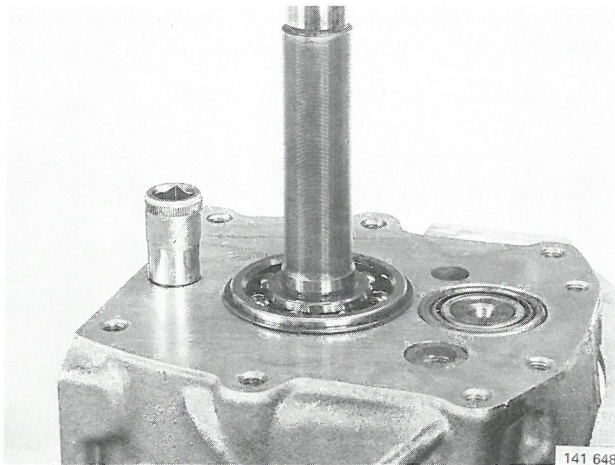
Select shim thickness **1.00 mm** (0.040 in).

Following shim thicknesses are available:

	mm	in
948008-4	0.60	0.024
948009-6	0.75	0.030
948010-4	0.90	0.036
948011-2	1.00	0.040



138 288

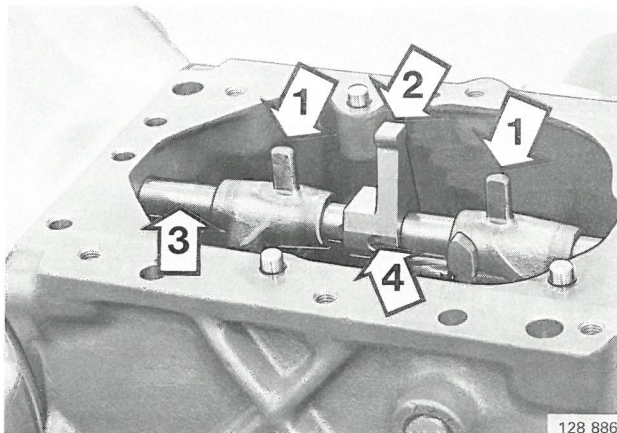


Installing intermediate section

B49

Install selector shaft seal in housing

Use a socket to depress seal.



B50

Install shift forks (1)

Make sure lugs face correctly.

B51

Install gear selector (2) and selector shaft (3)

Gear selector collar forwards, grooves in selector shaft facing UP.

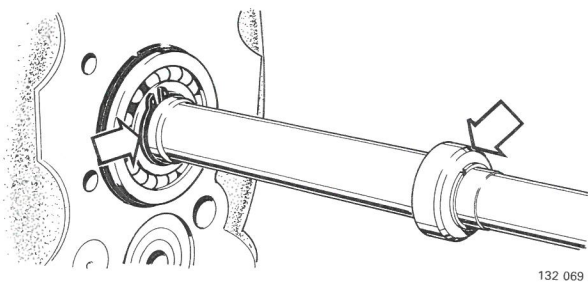
B52

Install lock pin (4) in gear selector

B53

Install lock ring for bearing and oil pump cam with lock ring

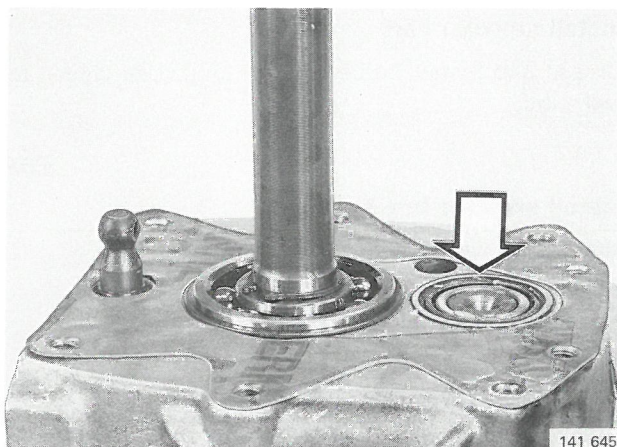
Install key for cam in main shaft.

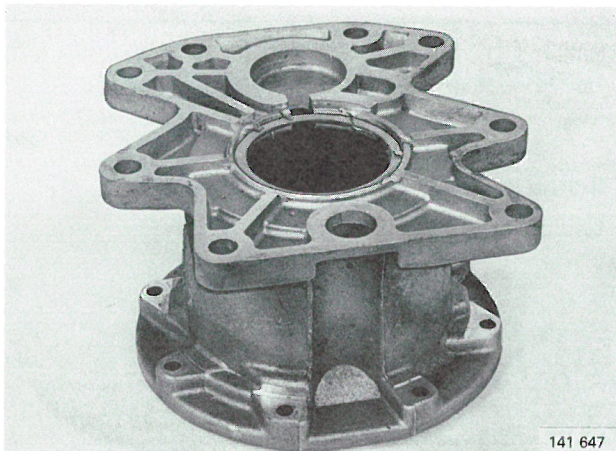


B54

Grease transmission rear face. Position gasket and shims for countershaft

Grease shims to hold them in position.

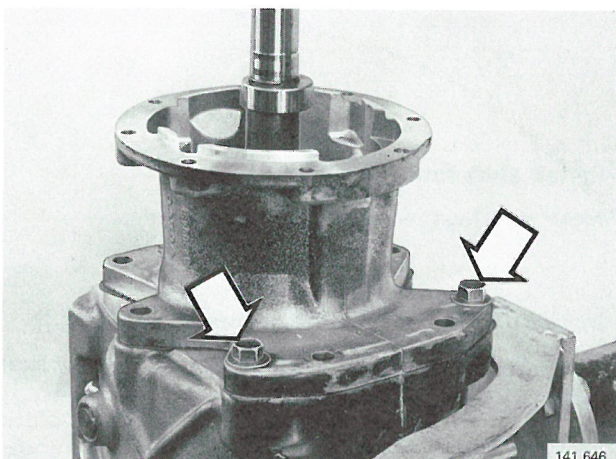




B55

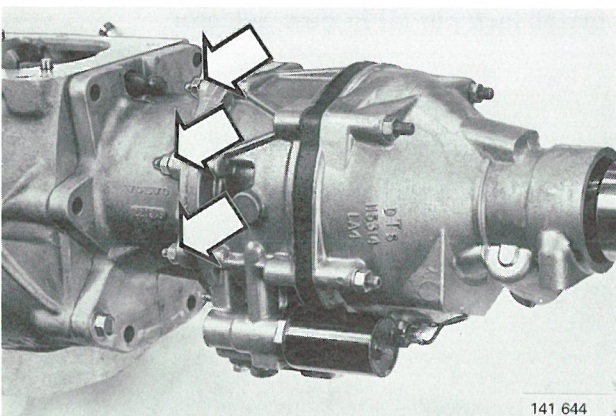
Position main shaft shims in intermediate section

Use grease to hold shims in position.



B56

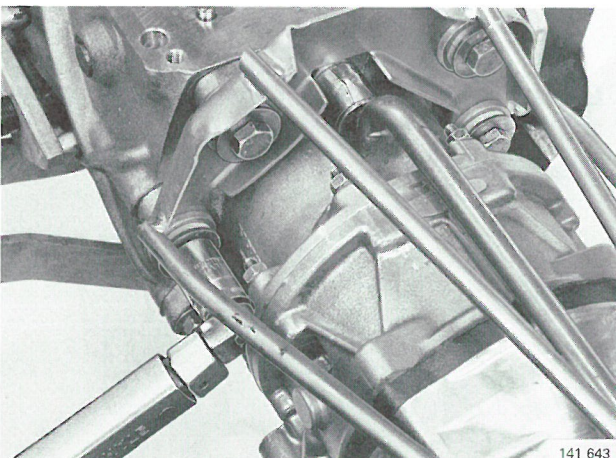
Install intermediate section



B57

Install overdrive

Torque bolts to 12 Nm (9 ft lb).



B58

Install selector rod

Grease and install rubber ring in joint. Use sleeve to lock pins.

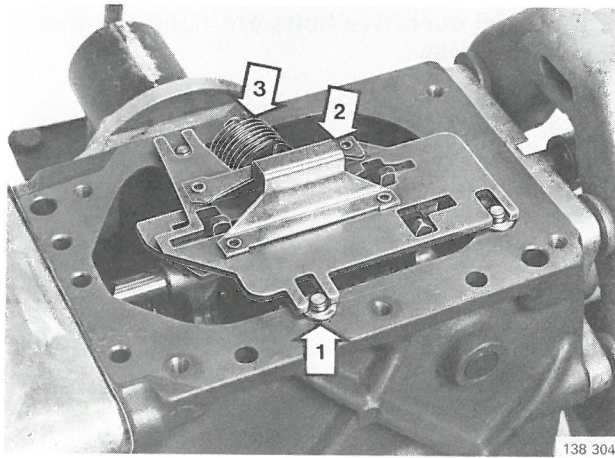
B59

Install selector bracket

Note: Bolt-washer-spacer tube-washer.

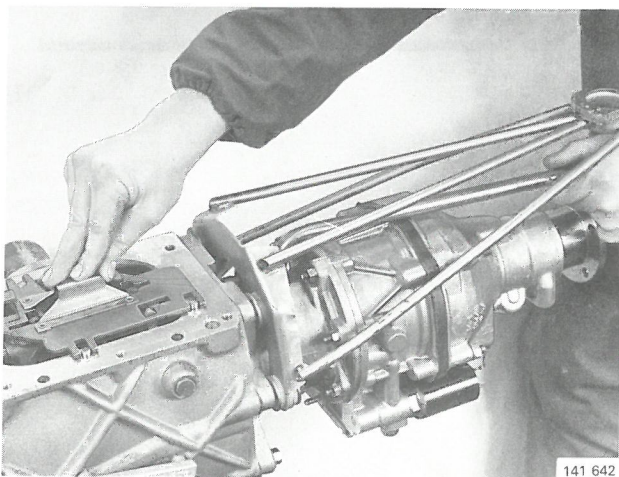
Torque bolts for rear end.

Torque: 35–50 Nm (25–35 ft lb).



B60

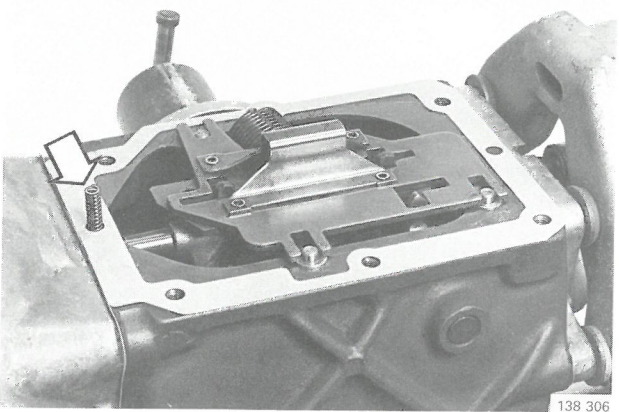
Install washers (1), selector plate (2) and return spring (3)



B61

Check function

Move selector plate by hand to check that all gears can be engaged and disengaged.



B62

Grease contact face and position gasket

B63

Install interlock ball and spring

B64

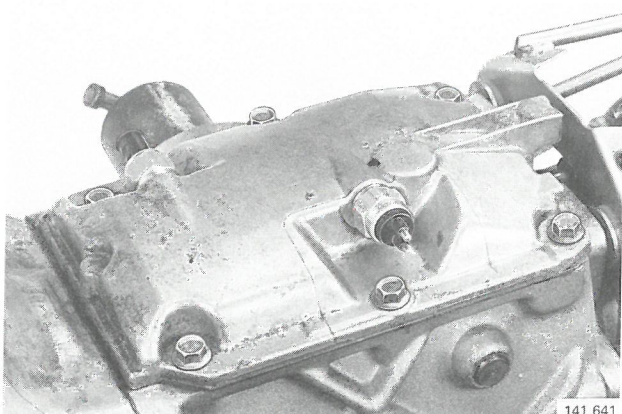
Install transmission cover

Torque bolts to 15–25 Nm (11–20 ft lb).

B65

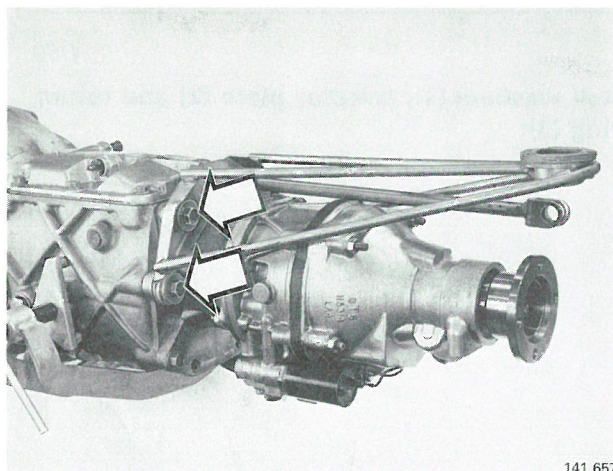
Install reversing light (back-up light) switch

Also install overdrive switch and attach wire from solenoid.



B66

Check that all overdrive bolts are tight and that there are no leaks

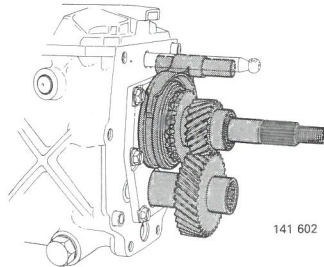


141 657

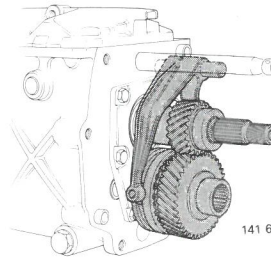
C. Disassembling M 47, M 47 II

Special tools: 5130+2520 or 5154, 2853, 2985, 5058, 5131, 5147, 5148, 5261, 5262, 5304, 5305, 5973, 5986

On M 47 II the 5th gear synchroizer is on the counter shaft. On the early version (M 47 – 1985) it is on the main shaft.

M 47

141 602



141 603

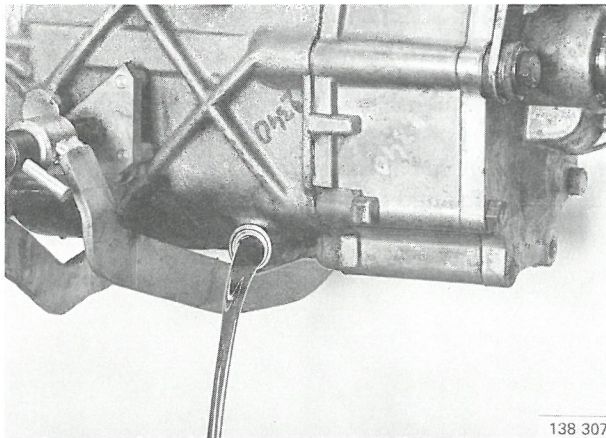
M 47 II

C1

Mount transmission on fixture 5130 on floor stand 2520 or bench support 5154

C2

Drain oil



138 307

C3

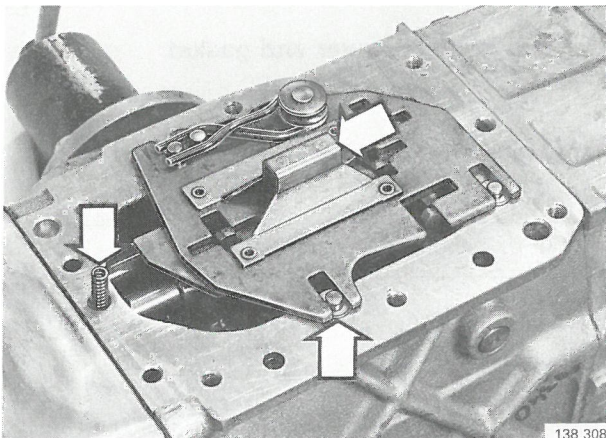
Remove transmission cover and gasket

Remove selector plate.

C4

Remove selector plate

Lift off washers, spring and interlocking ball.



138 308

C5

Remove clutch fork

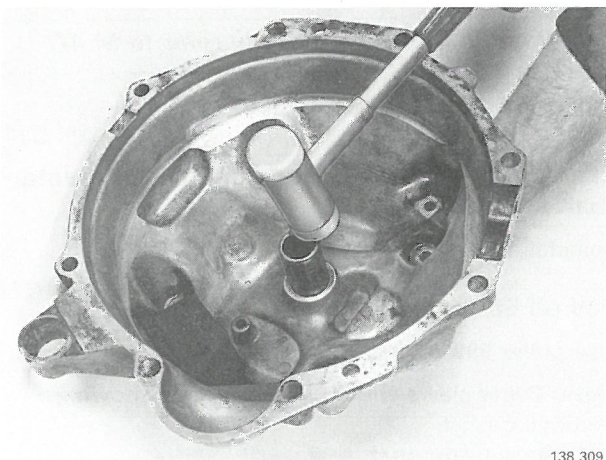
Save spacer washer. Remove release bearing.

C6

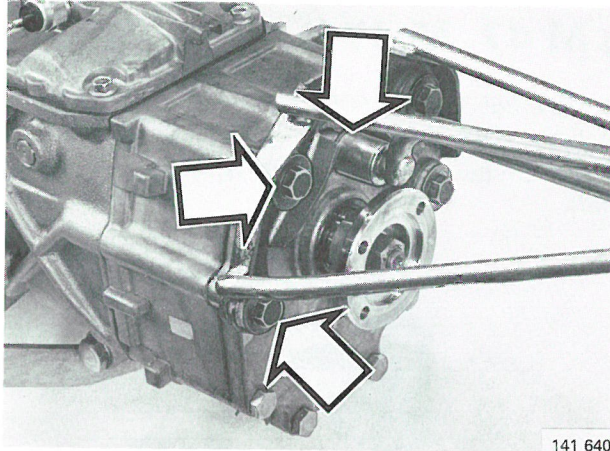
Remove clutch housing ("bell housing") and gasket

Save adjusting shims.

Tap pipe rearwards to loosen seal. Some pipes have a lock ring, remove it first.



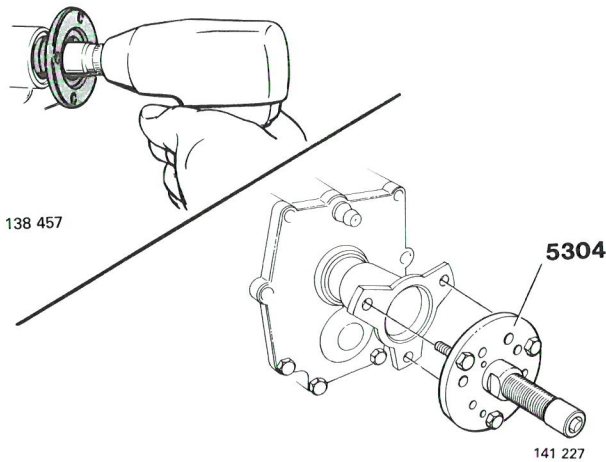
138 309



141 640

C7

Remove gear selector bracket and selector rod



138 457

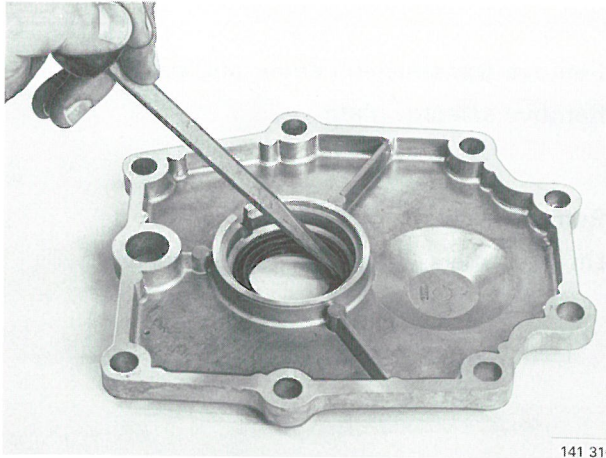
141 227

Remove drive flange

Engage two gears to lock transmission, prior to loosening nut.

If drive flange is difficult to remove, use puller **5304**. It fits both the round and three-armed drive flanges.

C8



141 310

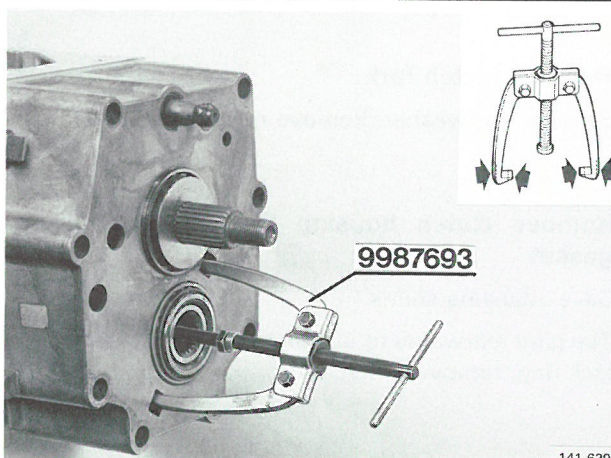
Remove rear end cover and gasket

C9

Remove rear end cover seal

C10

M 47 II: proceed to operation C22.



141 639

Operations C 11 to C 21 only refer to M 47.

Removing 5th gear, M 47

C11

Remove bolt, washer and shims for counter-shaft

Reinstall bolt, 5–6 turns, no washer.

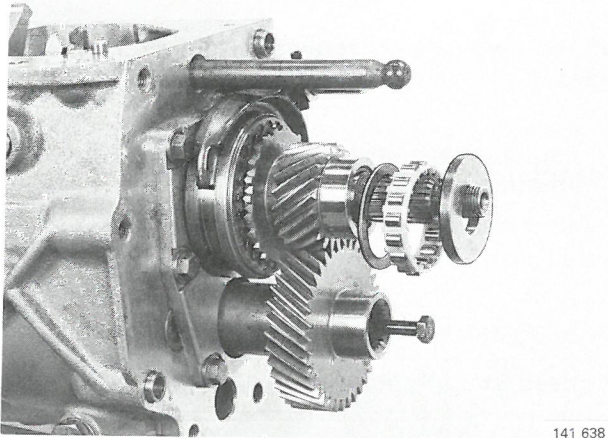
Pull off 5th gear housing

C12

Use puller **998 7693-0**

Note: Puller claws should be ground as shown. Remove gasket.

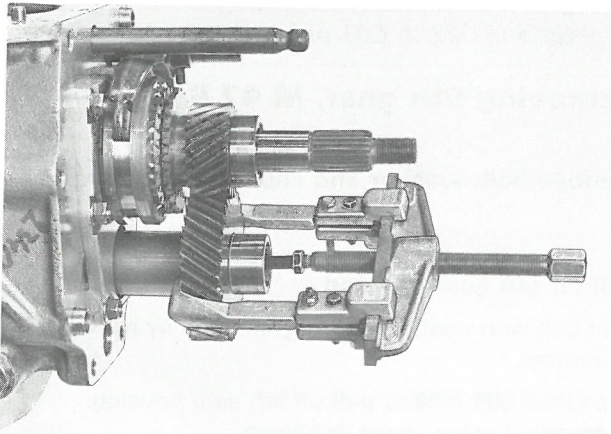
Remove selector shaft seal.



141 638

C13

Remove thrust washer and roller bearing with washer



138 313

C14

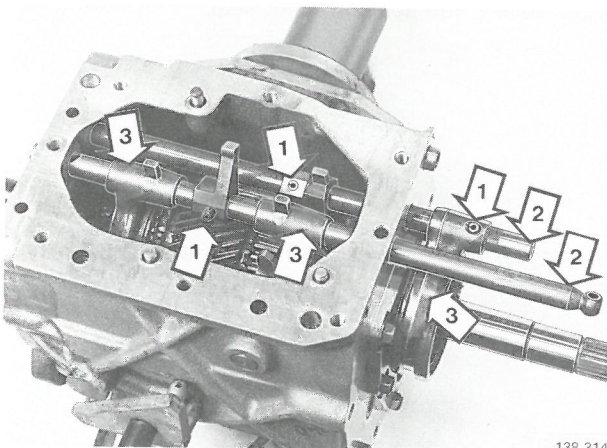
Pull off gear wheel from countershaft

Use universal puller.

C15

Remove gear wheel with needle bearing, support ring and synchronizer ring from main shaft

Remove long bolt from countershaft.



138 314

C16

Tap out three pins (1)

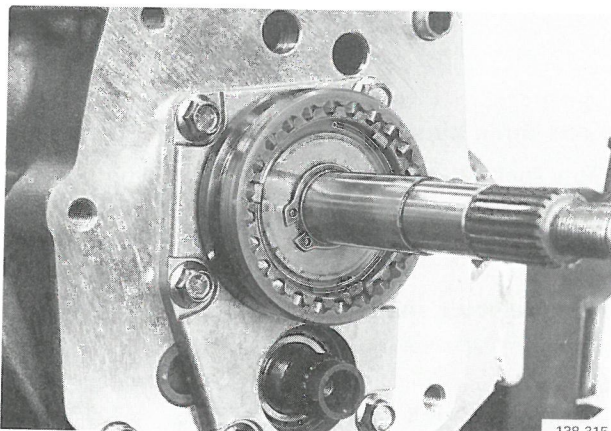
Support shafts to prevent them from bending when pins are removed.

C17

Pull out selector shafts (2)

C18

Remove shift forks (3)

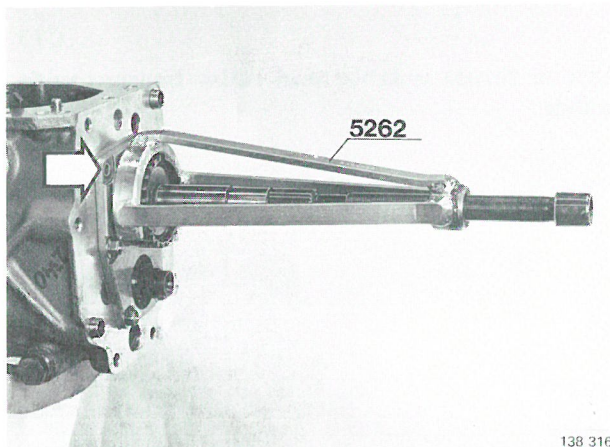


138 315

C19

Remove spring. Disassemble 5th gear synchronizer.

Remove lock ring for hub.



138 316

C20

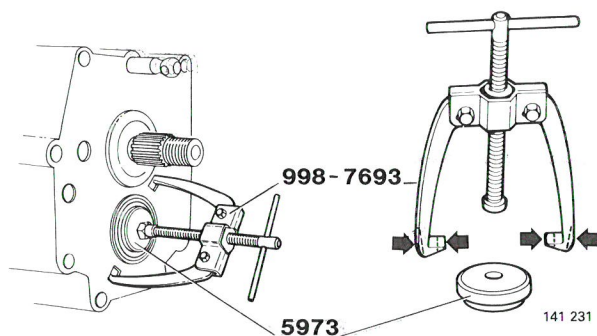
Remove two upper screws retaining bearing holder

C21

Pull off hub

Use puller 5262.
Save adjusting shims.

Proceed to operation C32.



Operations C22 to C31 only apply to M 47 II.

Removing 5th gear, M 47 II

C22

Remove bolt, washer and countershaft shims

C23

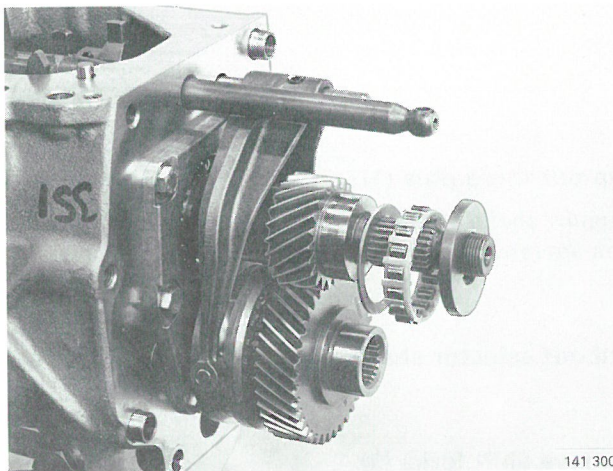
Pull off 5th gear housing

Refit bolt with washer 5973. Tighten bolt by hand until it bottoms.

Use puller 998 7693 to pull off 5th gear housing.

Note: grind puller claws as shown.

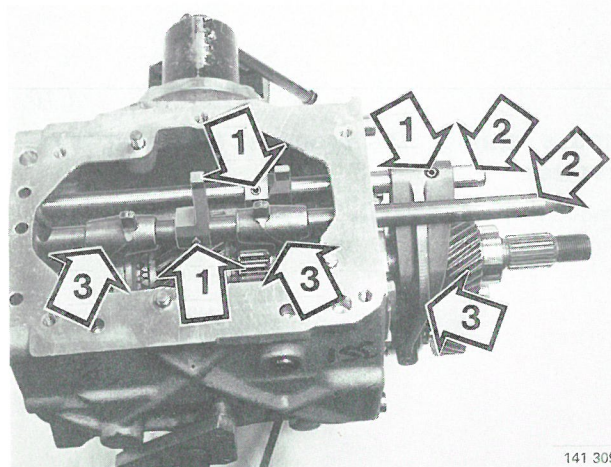
Remove gasket and selector shaft seal.



141 300

C24

Remove thrust washer and roller bearing with washer



141 309

C25

Tap out three pins (1)

Support shafts to prevent them from bending when pins are removed.

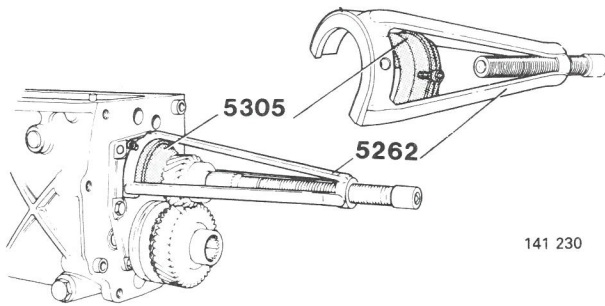
C26

Pull out selector shafts (2)

C27

Remove shift forks (3)

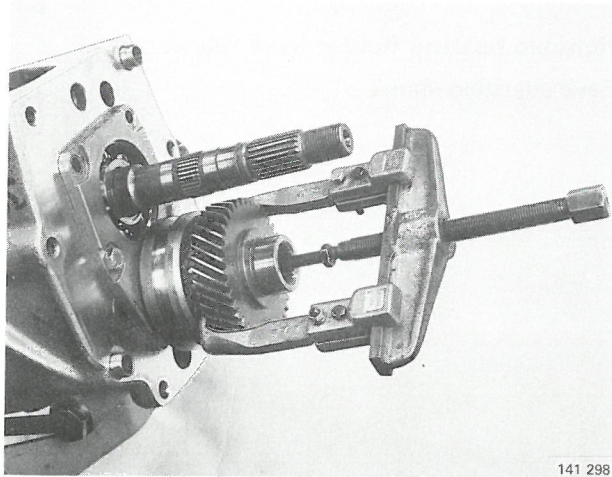
C28



Pull off 5th gear wheel

Remove two upper bearing holder screws.

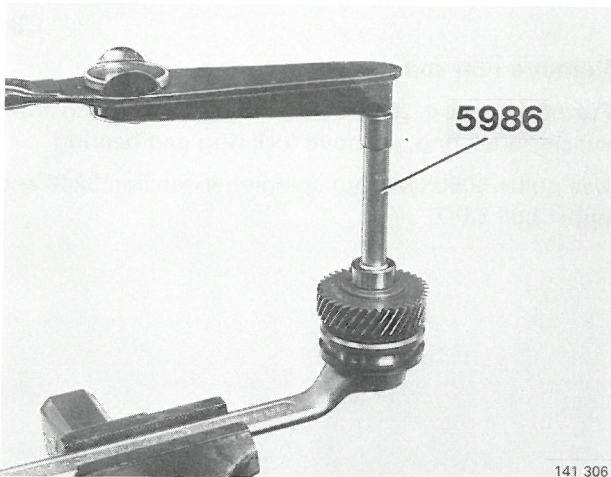
Use puller **5262** and ring **5305**.



C29

Pull off 5th gear wheel and synchronizer

Use universal puller, supported on bolt head.



C30

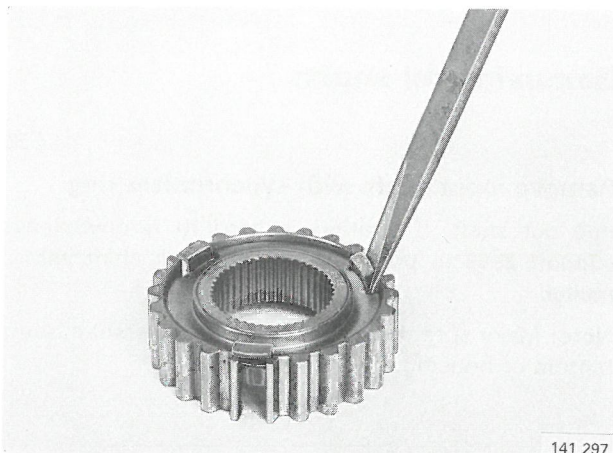
Disassemble 5th gear wheel/synchronizer

Clamp a box-end wrench in a vice. Place synchronizer nut in wrench.

Use shaft **5986** plus torque wrench to loosen nut.

Note: If nut comes loose at a lower torque than 30 Nm (22 ft lb), a **new nut** should be used when reassembling.

Dismantle parts.

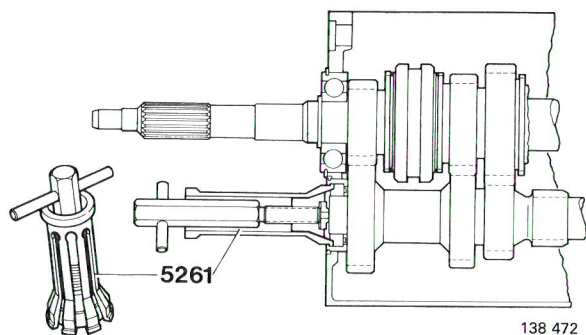


C31

Remove washer on 5th gear synchronizer hub

This operation should only be performed if a part is to be replaced.

Use screwdriver to pry washer loose.

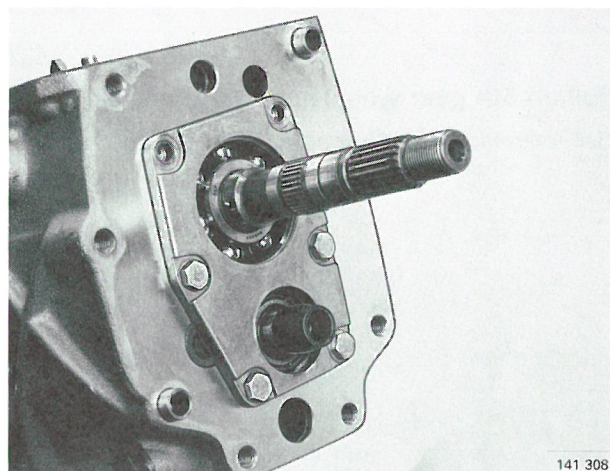


C32

Pull out front countershaft bearing

Use puller 5261.

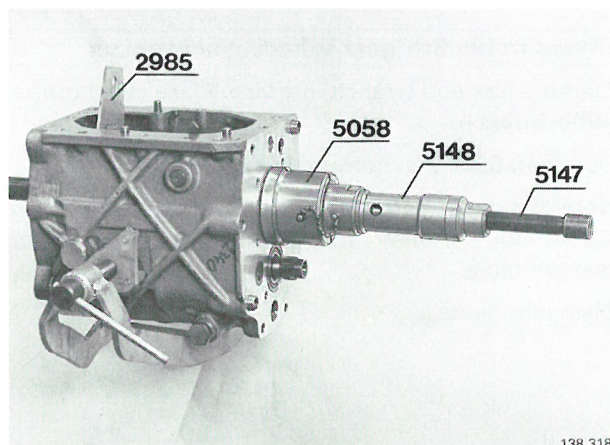
Insert puller claws between rollers, pull out spindle to expand puller and pull out bearing.



C33

Remove bearing holder from rear face

Save adjusting shims.

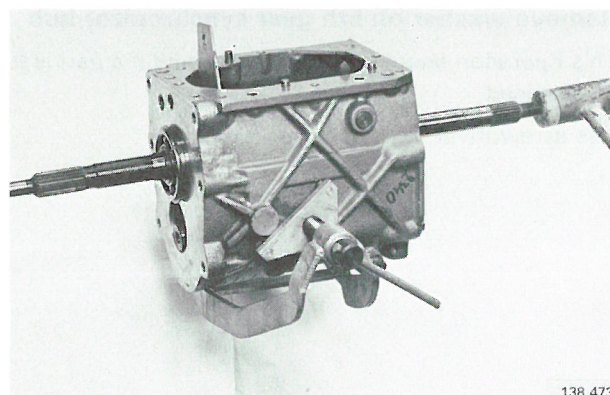


C34

Remove rear main shaft bearing

Position support 2985 between input shaft and front synchronizer ring. Remove lock ring and bearing.

Use puller 5058 (without spindle), extension 5148 and puller bolt 5147.



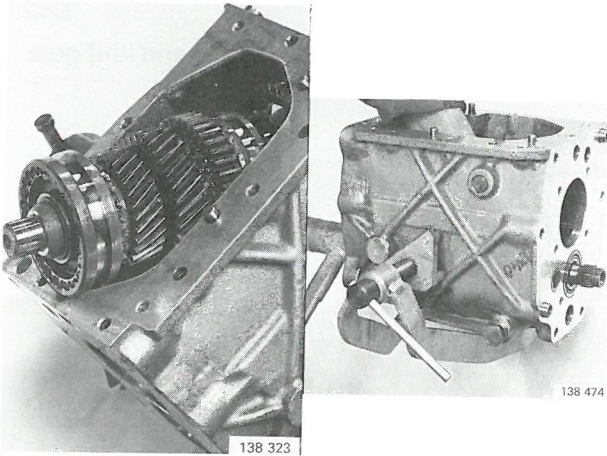
Removing all shafts

C35

Remove input shaft with synchronizer ring

Pull out shaft. If bearing is hard to remove leave support 2985 in position and tap main shaft with a mallet.

Note: Make sure that front part of countershaft abuts bottom of housing.



C36

Remove main shaft

Turn transmission and remove main shaft.

C37

Remove countershaft

Turn transmission back. Tap out rear bearing race with a plastic mallet. Remove countershaft.

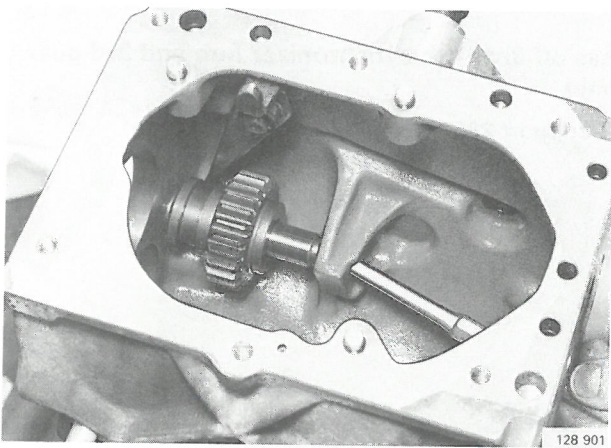
C38

Remove reverse gear and shaft

Use a drift to force shaft rearwards.

C39

Remove reverse gear shift fork

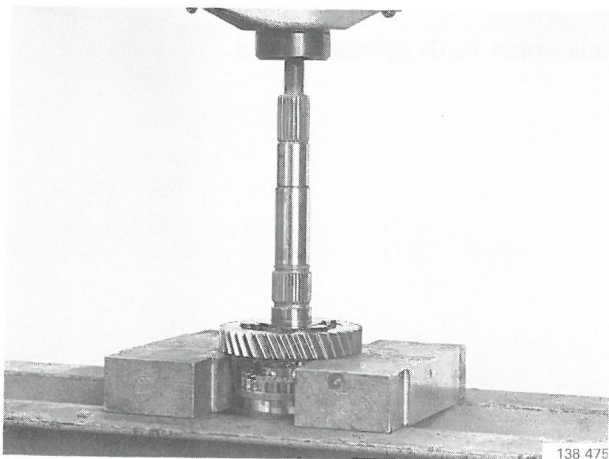


Disassembling main shaft

Transmission with damper:

C40

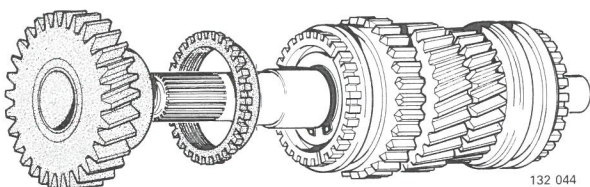
Press off washer. Remove springs and brake ring

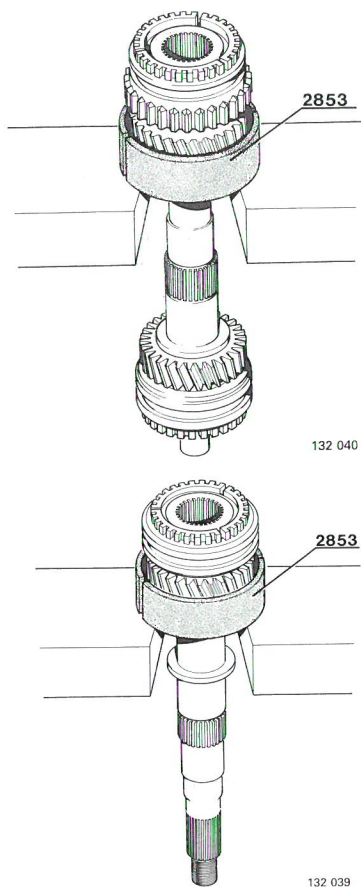


C41

Remove thrust washer and 1st gear wheel with synchronizer ring

Remove lock rings for synchronizer hubs.





C42

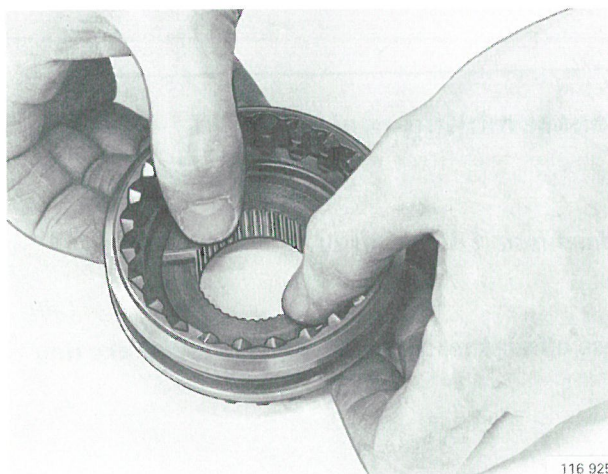
Press off 1st—2nd synchronizer hub and 2nd gear wheel with synchronizer ring

Use support 2853.

C43

Press off 3rd—4th synchronizer hub and 3rd gear wheel.

Use support 2853.



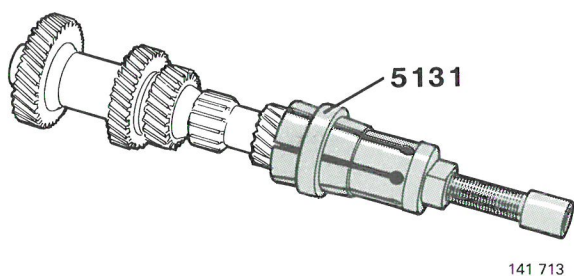
C44

Disassemble both synchronizers

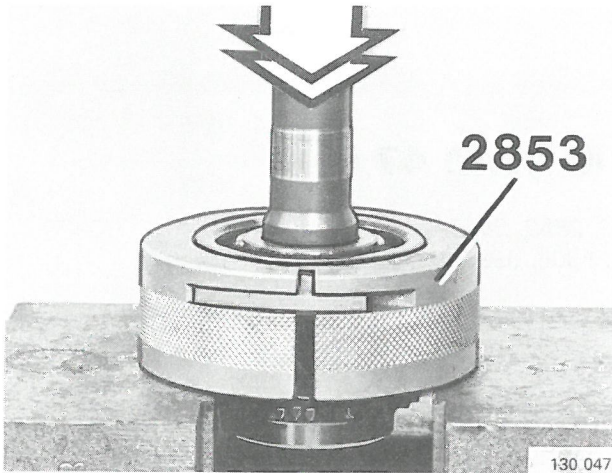
C45

Remove bearing on countershaft

Use puller 5131.



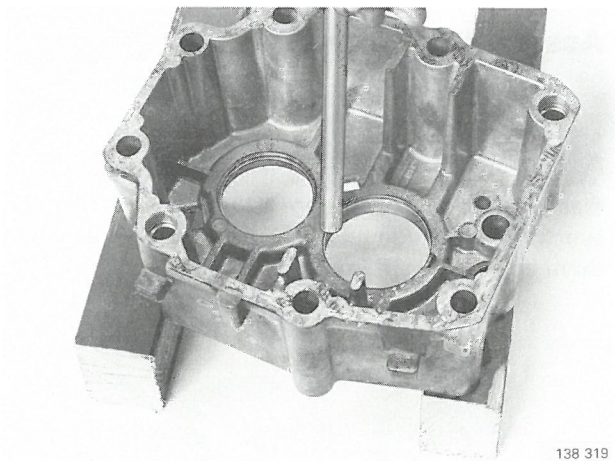
C46



Remove input shaft bearing

Use support **2853**.

C47



Remove bearing races from 5th gear housing

Use brass drift.

C48

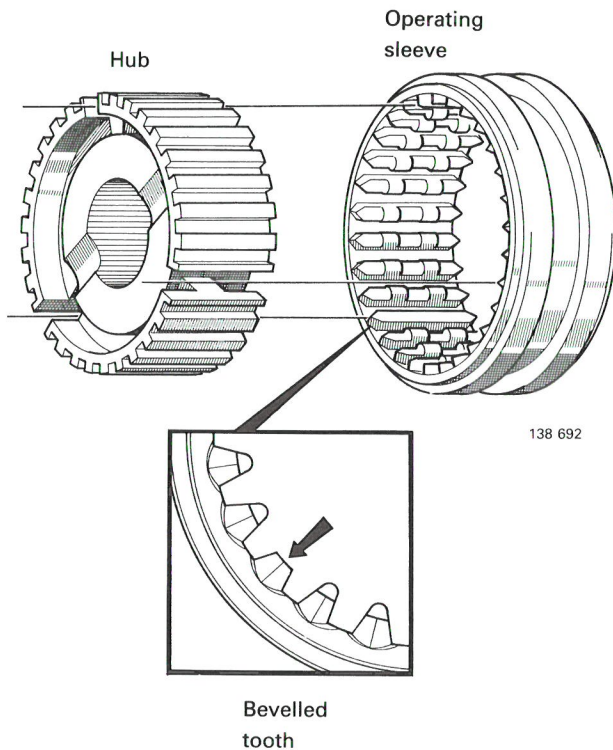
Clean and check

Clean all parts in solvent. Dry with compressed air.

Check all parts. Replace all worn or damaged parts and all gaskets and seals.

D. Assembling M 47/M 47 II

Special tools: 1801, 2413, 2852, 2853, 2867, 2985, 5064, 5090, 5096, 5306, 5986, 9177

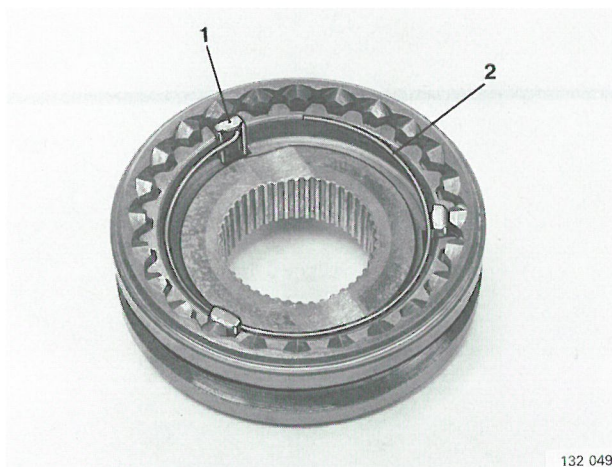


Assembling main shaft

D1

Assemble both synchronizers

Place hub in operating sleeve. 3rd-4th gear synchronizer: Three recesses in hub should align with three bevelled teeth in operating sleeve.



D2

Install sliding keys (1) and springs (2)

Lock sliding keys ("dogs") with springs. Hook both springs to the same sliding key.

Install one spring counter-clockwise. Turn synchronizer over and install second spring, also counter-clockwise.

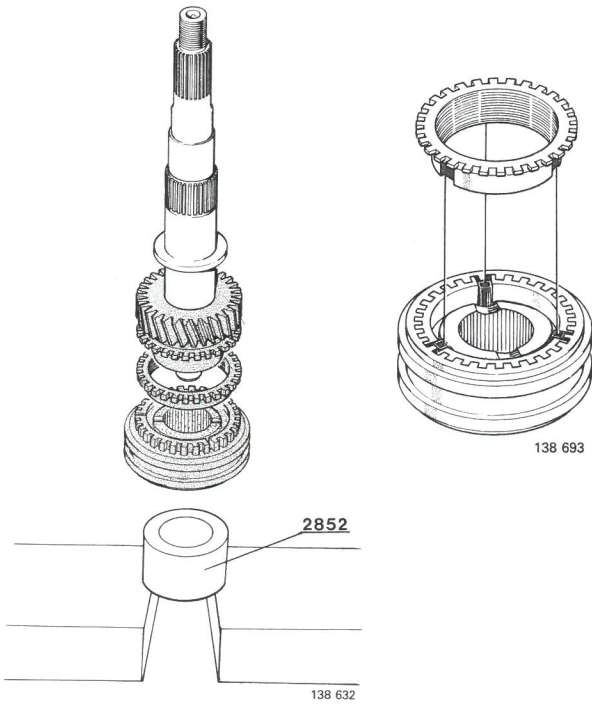
If spring is bent, free end must point away from hub.

D3

Oil main shaft. Install 3rd gear wheel and synchronizer ring. Press on 3rd–4th gear synchronizer hub.

Make sure synchronizer ring is facing correct way.

Turn wear surface on synchronizer hub UP. Use support 2852.

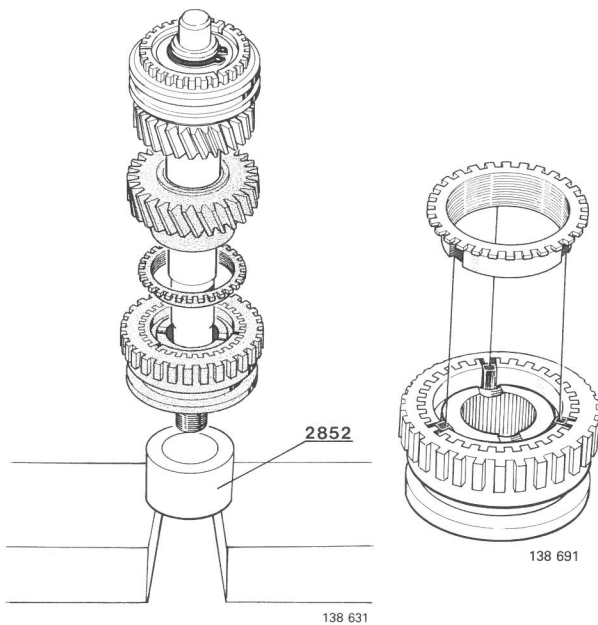


Invert shaft

D4

Oil shaft. Install 2nd gear wheel and synchronizer ring. Press on 1st–2nd gear synchronizer hub.

Make sure synchronizer ring is fitted correctly. Use support 2852.



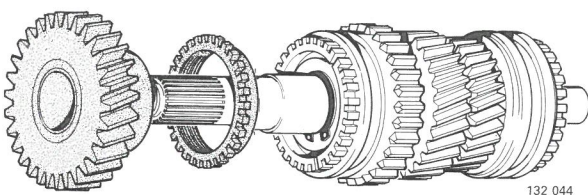
D5

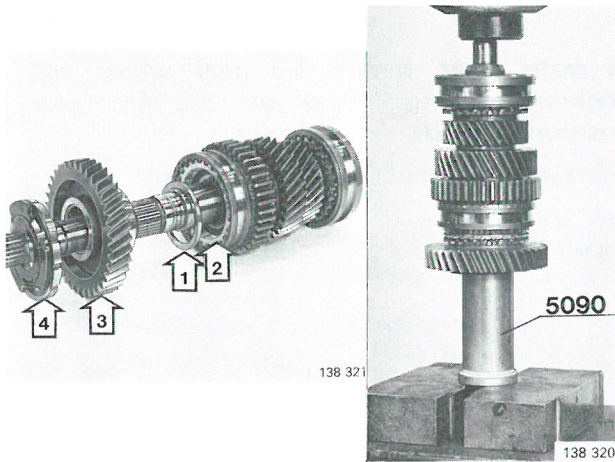
Install lock rings for both synchronizers

Transmission without damper:

D6

Install synchronizer ring and gear wheel for 1st gear and thrust washer





Transmission with damper:

D7

Install thrust washer (1) if applicable, synchronizer ring (2) and 1st gear wheel (3)

D8

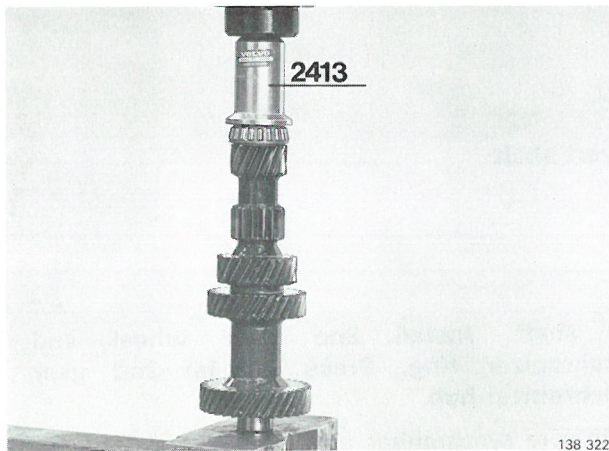
Assemble damper

Oil parts. Position springs in brake ring and twist washer into brake ring.

D9

Press damper (4) on main shaft

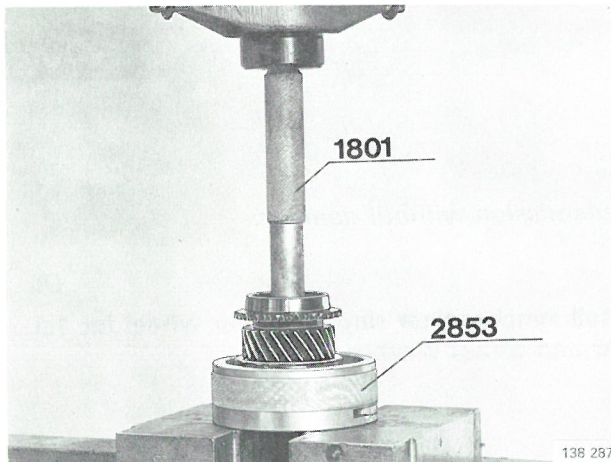
Use a file to remove sharp edges. Use 5090 to press on damper.



D10

Press rear bearing on countershaft

Use drift 2413.



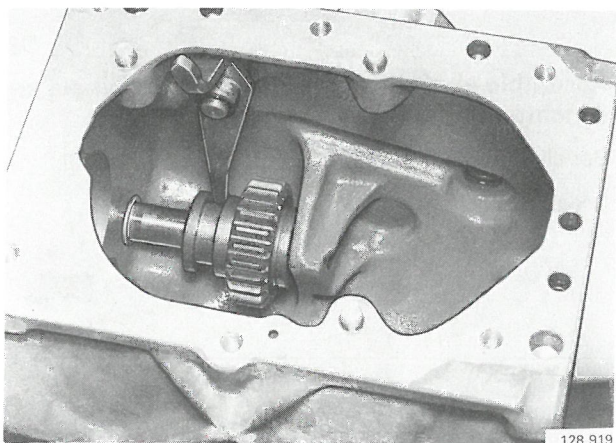
D11

Press bearing on input shaft

Use standard handle 1801 and support 2853.

D12

Install lock ring on input shaft



Installing shafts

Note: Apply assembly paste to aluminium surfaces prior to installing bearings and shafts.

Part Number 1 161 006-9 Aerosol
1 161 078-9 Can

D13

Position reverse gear shift fork

Install lock ring.

D14

Install reverse gear and shaft

D15

Check/adjust position of reverse gear

Shaft end should be flush with housing or max. 0.05 mm (0.002 in) below housing face.

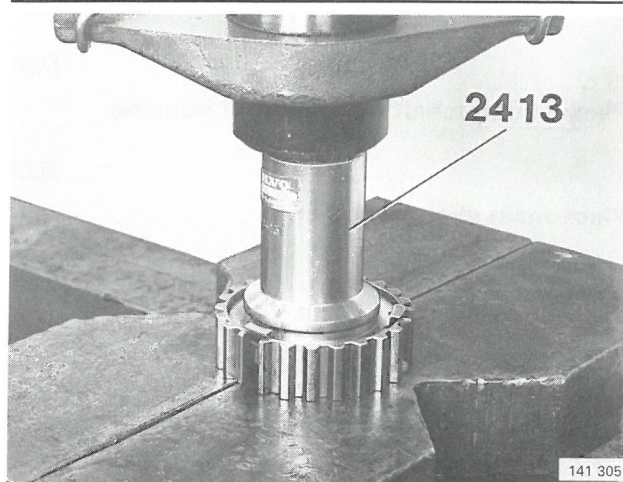
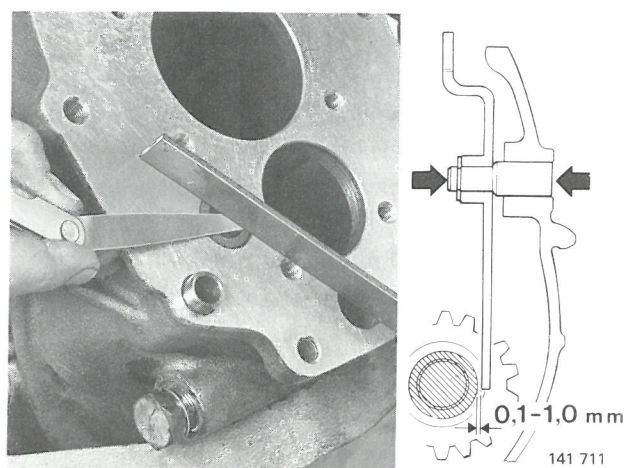
D16

Check/adjust clearance between reverse gear wheel and shift fork

Adjust by tapping shift fork bearing stud, with a drift.

Correct clearance: 0.1–1.0 mm (0.004–0.040 in).

M 47: proceed to operation D 22.



Operations D 17 to D 21 only apply to M 47 II.

Assembling 5th gear synchronizer and gear wheel

D17

Fit washer to 5th gear synchronizer hub

Use drift **2413**. First position spring counter-clockwise in hub.

D18

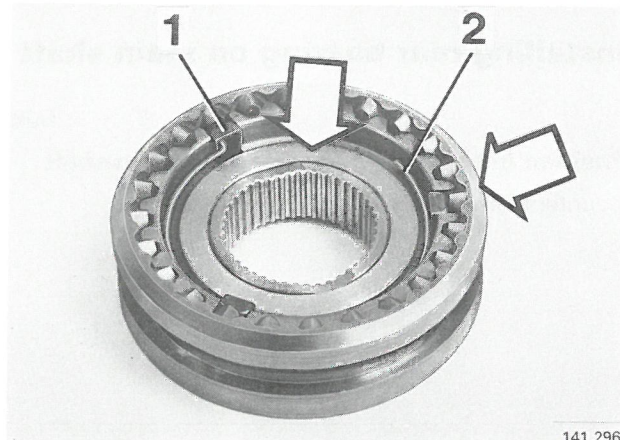
Assemble hub and operating sleeve

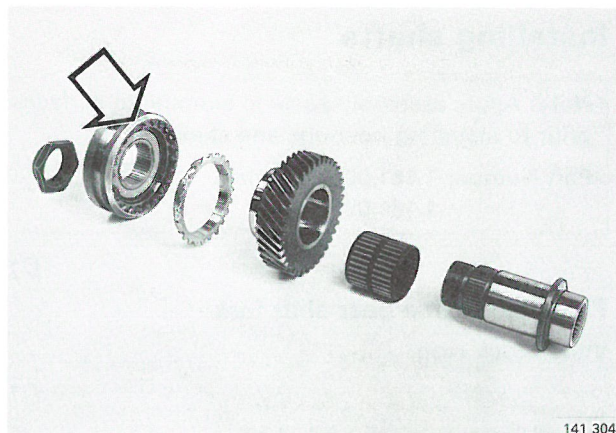
Three recesses in hub should align with three bevelled teeth in operating sleeve. Hub washer and bevelled part of operating sleeve should face same direction.

D19

Install sliding keys (1) and spring (2)

The two springs should hook on to the same sliding key. Position spring counter-clockwise as shown in illustration.



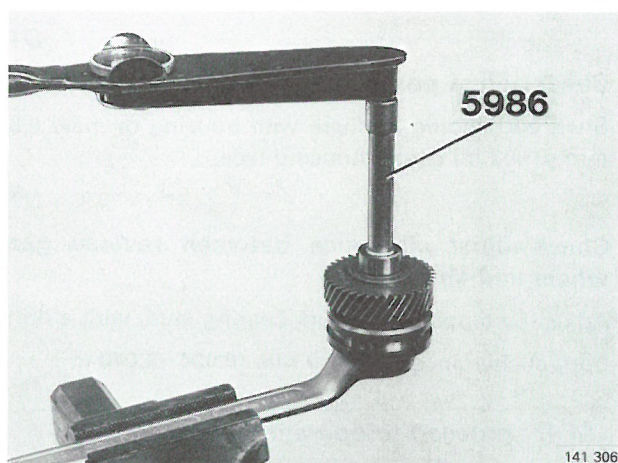


D20

Assemble shaft, needle bearing, gear wheel and synchronizer

Bevelled edge of sleeve should face gear wheel.

Install nut finger tight.



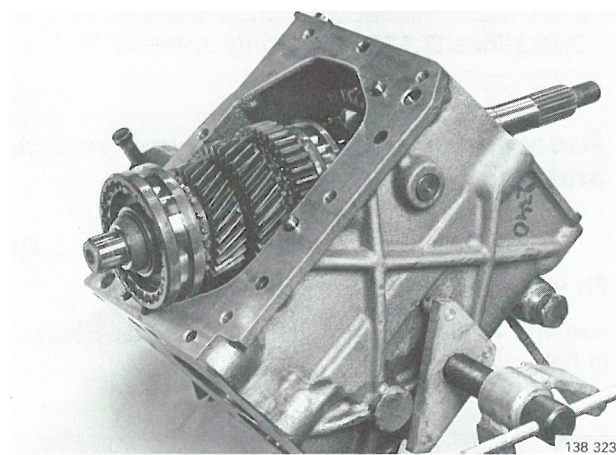
D21

Torque nut

Clamp a 42 mm box-end wrench in a vice. Place nut in box-end wrench. Use shaft 5986 and torque wrench.

Note: During tightening, torque should be 40–80 Nm (30–60 ft lb). If below, replace nut.

Torque: 120 Nm (88 ft lb).



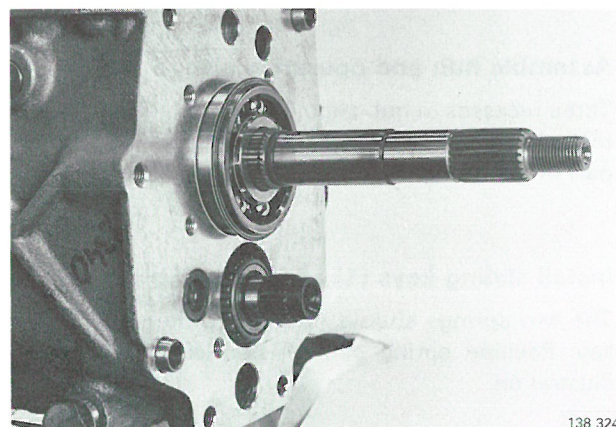
D22

Place countershaft in bottom of housing

D23

Place main shaft in housing

First turn housing.



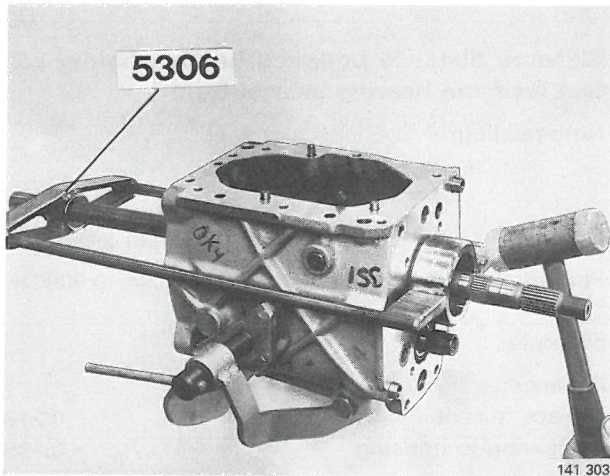
D24

Installing rear bearing on main shaft

Position bearing with lock ring on main shaft

Countershaft should lie in bearing recesses.

D25

**Press main shaft bearing into position**Use press tool **5306**.

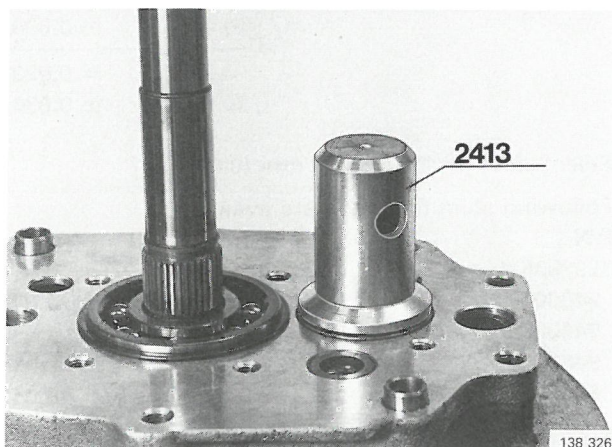
Take care not to damage gear teeth when pressing bearing into position.

D26

Make sure bearing lock ring abuts housing

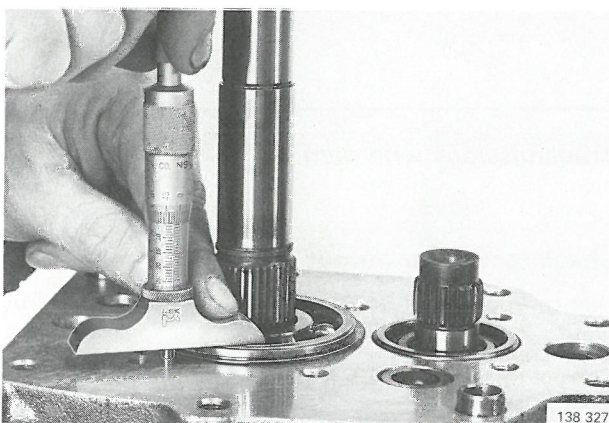
If necessary, tap press tool with a mallet until bearing seats correctly.

D27

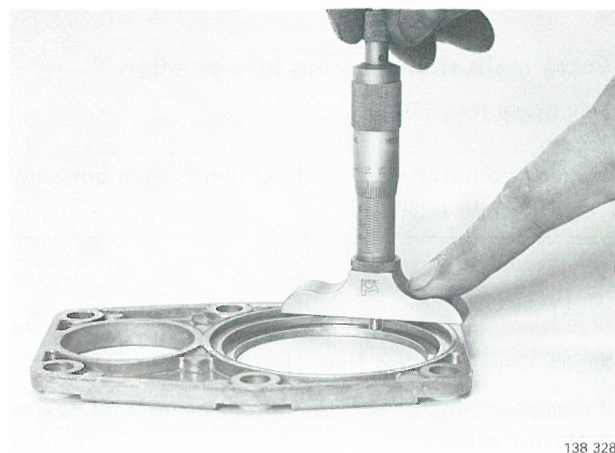
**Install rear countershaft bearing race**Use drift **2413**.**Note:** Top of race must be below housing face. Race will take correct position when cage is installed.**Determining thickness of main shaft shims**

Main shaft end float should be 0.01–0.20 mm (0.0004–0.0080 in). If main shaft bearing or bearing holder has been replaced, shim thickness should be determined.

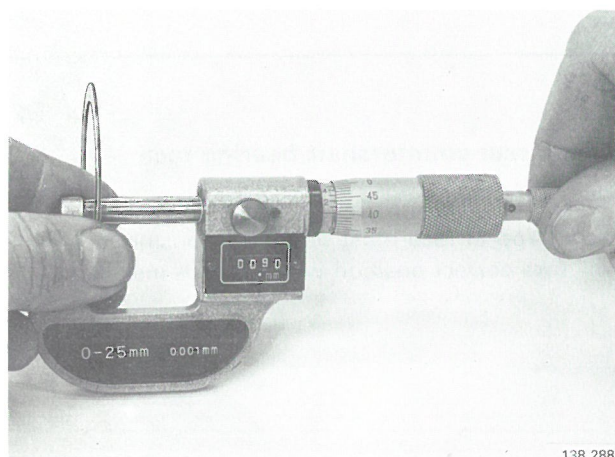
D28

**Measure distance between outer face of main shaft bearing and rear face of transmission housing**

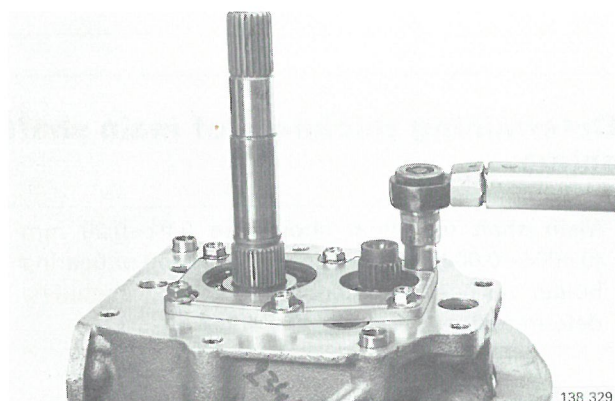
Use depth micrometer and note reading.



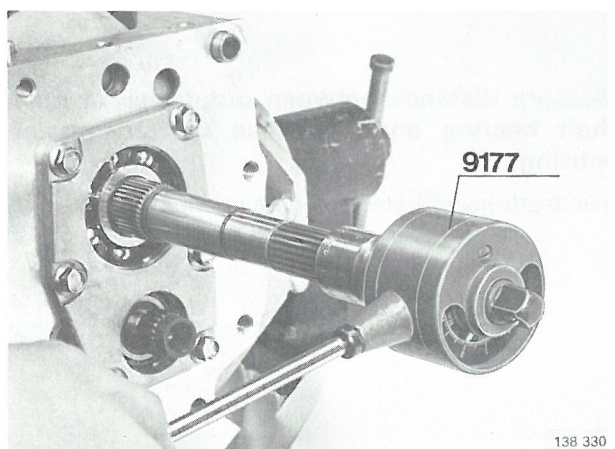
138 328



138 288



138 329



138 330

D29

Measure distance between bearing holder contact face and bearing seat bottom

Note reading.

D30

Calculate thickness of shims for main shaft

Permitted end float: 0.01–0.20 mm (0.0004–0.0080 in).

Example:

Distance:	mm	in
– Face to seat	5,50	0.2165
– Bearing to housing	–4,71	–0.1854
	=0.79	=0.0311
Deduct end float	–0.01	–0.0004
	to 0.20	to 0.0080
	= 0.59	= 0.0231
	to 0.78	to 0.0307

Select shim thickness **0,75 mm** (0.030 in)

Following shim thickness are available:

P/N	mm	in
3292838-4	0.25	0.010
948008-4	0.60	0.024
948009-6	0.75	0.030
948010-4	0.90	0.036
948011-2	1.00	0.040

D31

Install bearing holder

Torque to 15–25 Nm (11–20 ft lb)

Note: Do not interchange short bolts with long cover bolts

Tap bearing holder to seat bearing races.

Transmissions with damper:

D32

Check torque for output shaft

Use torque gauge **9177** and hold 1st gear wheel by hand.

Correct torque: **0.8–2.5 Nm** (7–22 in lb)

M 47 II: Proceed to operation D 37.

Operations D33 to D36 only refer to M 47.

Installing 5th gear synchronizer hub Calculating shim thickness

Adjust bearing position to obtain a clearance of max 0.20 mm (0.008 in) to lock ring.

D33

Install original shim, as applicable

D35

Install lock ring

D36

Measure clearance between lock ring and hub

If clearance exceeds 0.20 mm, (0.008 in), remove hub and install shim.

Example:

Distance hub to lock ring : 0.25 mm (0.010 in)

Select shim thickness 0.15 mm (0.006 in)

Following shims are available:

P/N	mm	in
34615-5	0.10	0.004
120116-9	0.15	0.006
34614-8	0.35	0.014
947120-2	0.50	0.020

Proceed to operation D38.

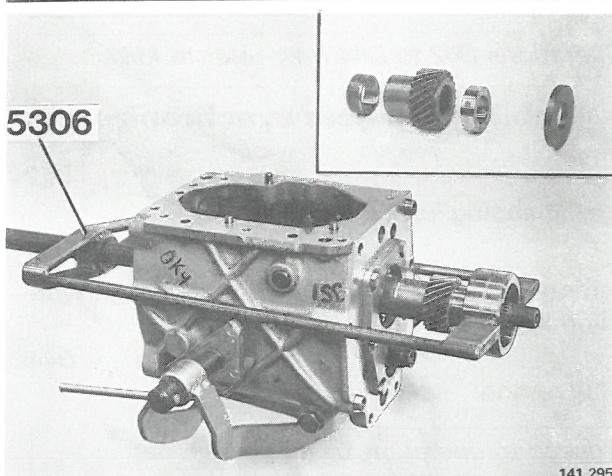
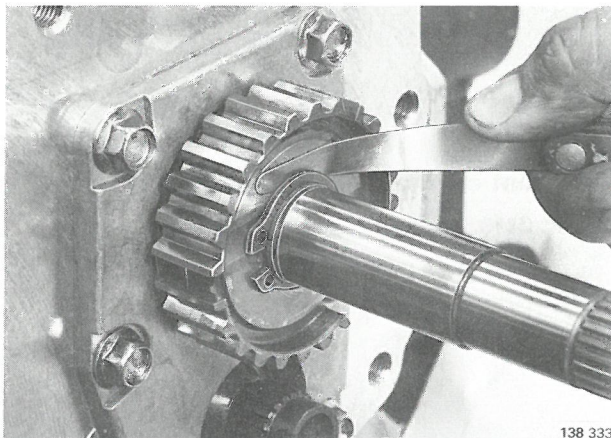
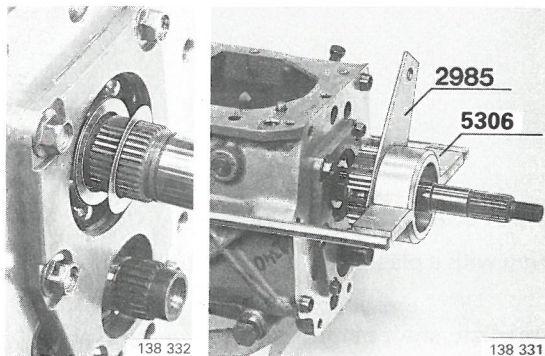
Operation D37 only applies to M 47 II.

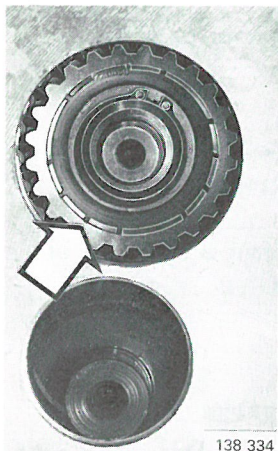
Installing 5th gear wheel

D37

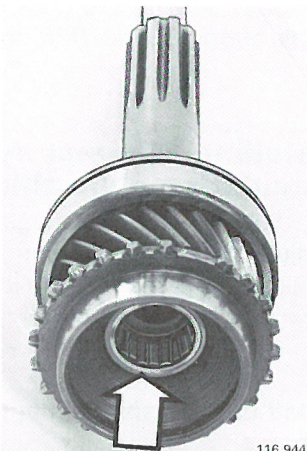
Press on spacer washer, 5th gear wheel and bearing race

Use press tool 5306 with thrust washer as support.





138 334



116 944

Installing input shaft

D38

Position 4th gear synchronizer ring in synchronizer hub

D39

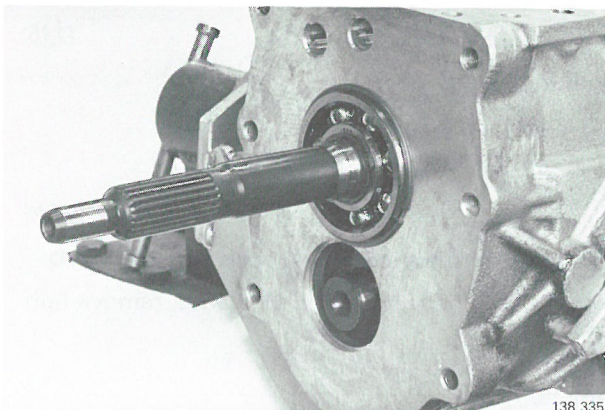
Grease and install roller bearing in input shaft

D40

Install input shaft, lift countershaft

Tap bearing with a plastic mallet if it is difficult to move it.

Lift intermediate shaft before positioning input shaft.

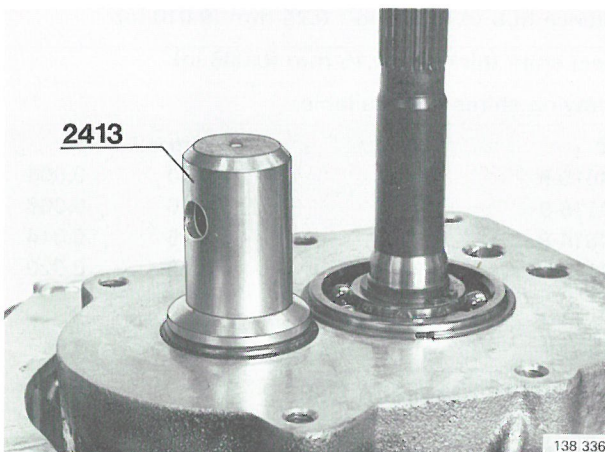


138 335

D41

Install front countershaft bearing

Use drift 2413.



138 336

M 47 II; Proceed to operation D 45.

Operations D42 to D44 only refer to M47.

Assembling 5th gear synchronizer, M 47

D42

Install 3 sliding keys

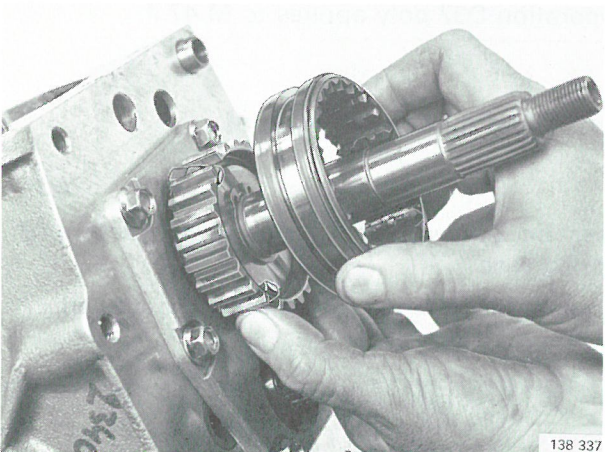
D43

Position sleeve so that bevelled teeth align with sliding keys

D44

Install spring

Proceed to operation D47.



138 337

Operations D 45 to D 46 only refer to M 47 II

Installing 5th gear and synchronizer, M 47 II

D45

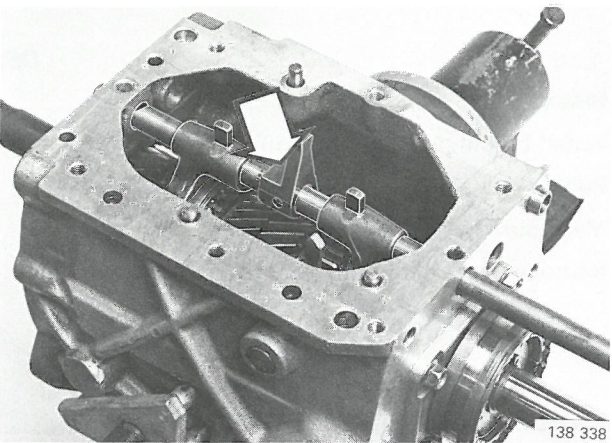
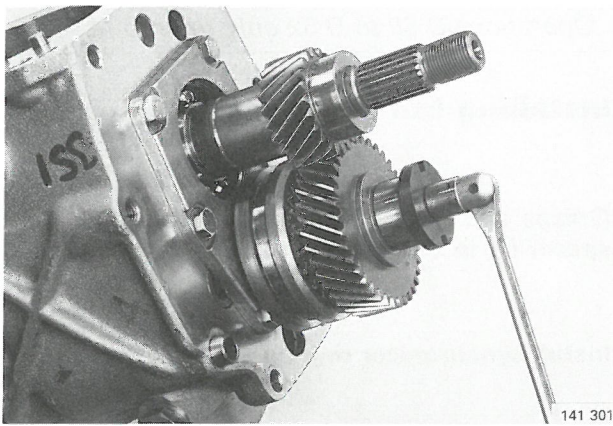
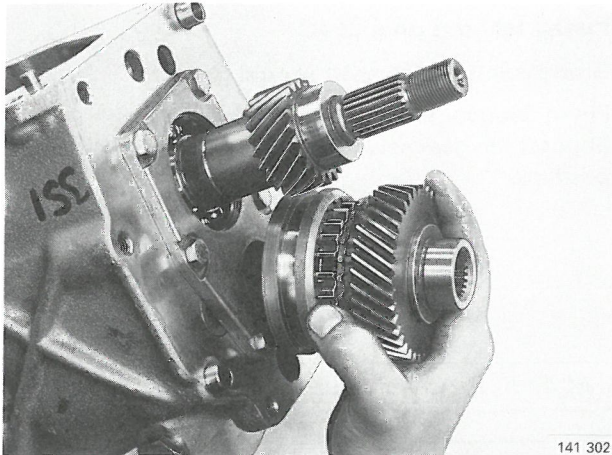
Install 5th gear synchronizer and gear wheel on countershaft

First pull out operating sleeve so that half of hub becomes visible. Then install synchronizer and gear wheel on countershaft.

D46

Press on synchronizer and gear wheel

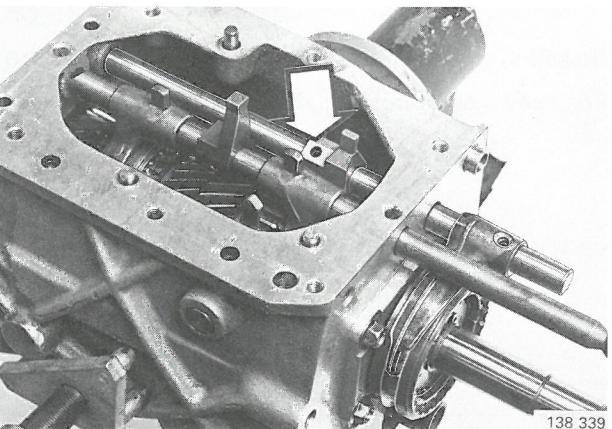
Install bolt and washer. Tighten until bolt bottoms.



D47

Install 1st—2nd and 3rd—4th gear selector fork, gear selector and selector shaft

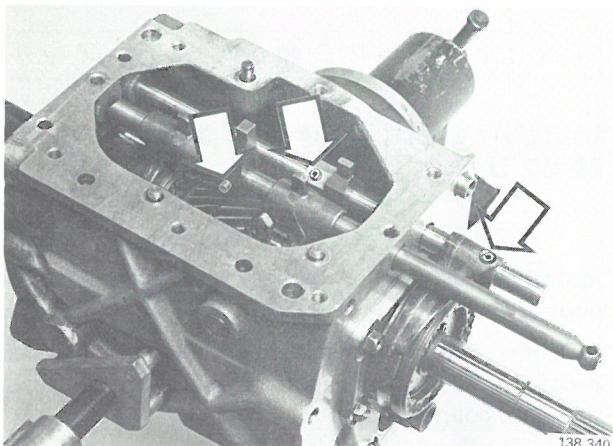
Make sure sliding lugs are positioned correctly. Gear selector lug should face forwards.



D48

Install 5th gear shift fork, gear selector and selector shaft

Gear selector lug should face forwards.



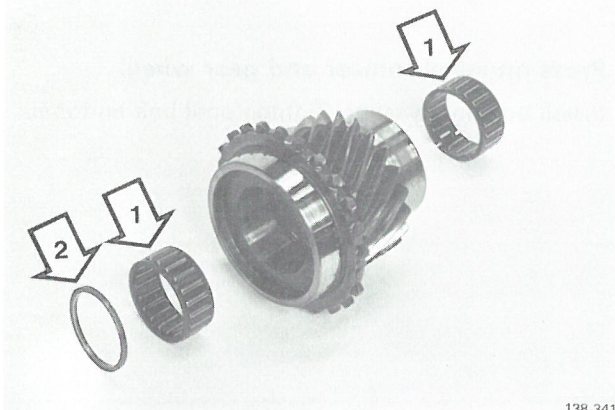
D49

Install locking pins (3 ×)

Grooves in selector shaft should face UP.

Pin in 5th gear shift fork should be flush with surface.
Support 5th gear selector shaft when tapping pins into position.

M 47 II: Proceed to operation D 53.



Operations D 50 to D 52 only refer to M 47.

Installing 5th gear wheel, M 47

D50

Grease and install two needle bearings (1) and spacer (2) in 5th gear wheel

D51

Install synchronizer ring on synchronizer hub

D52

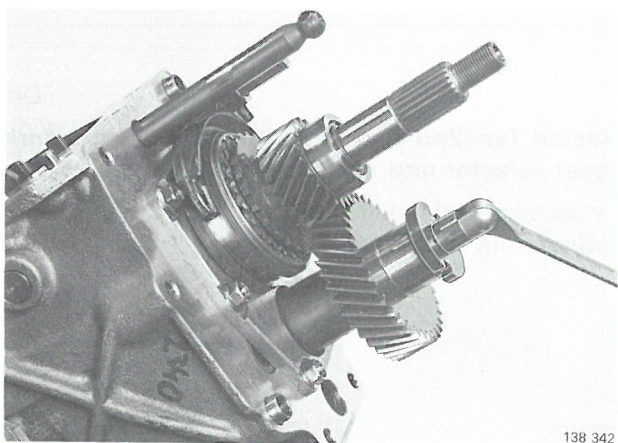
Install both gear wheels

Install bolt and washer on countershaft.

Pull bolt to press on large gear wheel.

Make sure large gear wheel is correctly positioned.

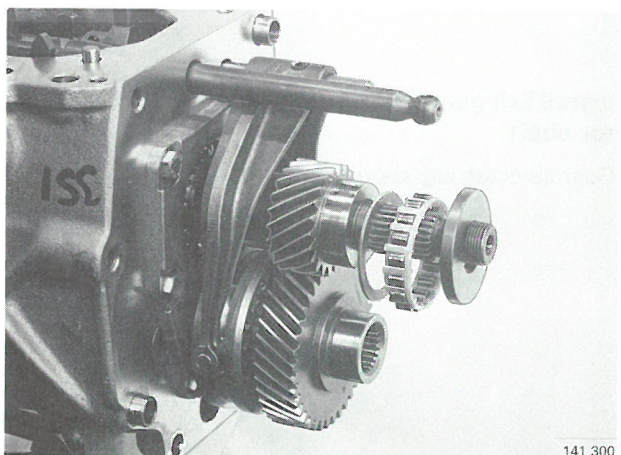
Remove bolt and washer.



D53

Install washer, roller bearing and thrust washer

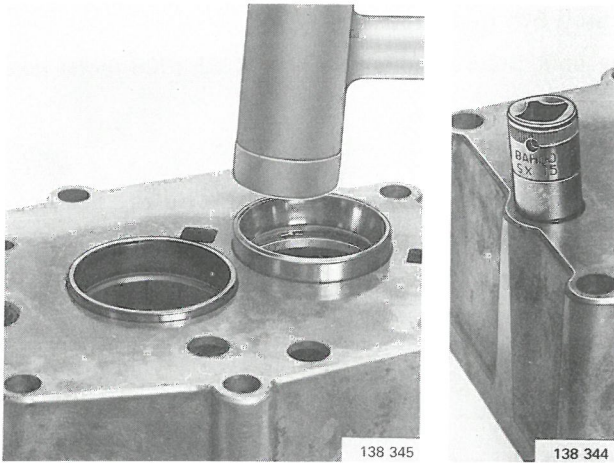
Enclosed side of bearing should face rearwards.



D54

Install bearing races and selector shaft seal in 5th gear housing

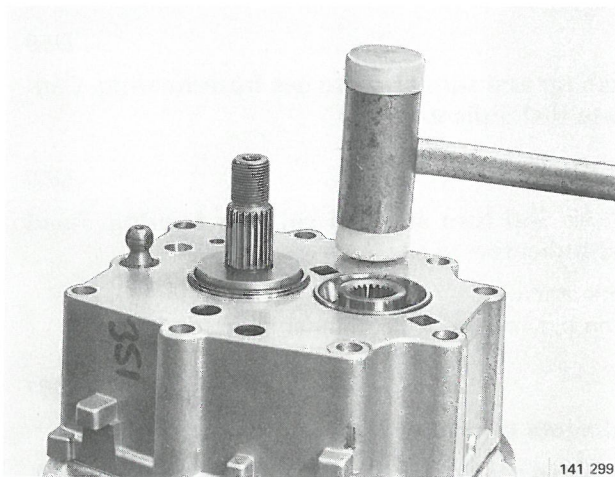
Tap bearing races into position with a plastic mallet. Use a socket to install selector shaft seal.



D55

Grease contact face, position gasket and install 5th gear housing

Carefully tap 5th gear housing into position.

**Determining countershaft shim thickness**

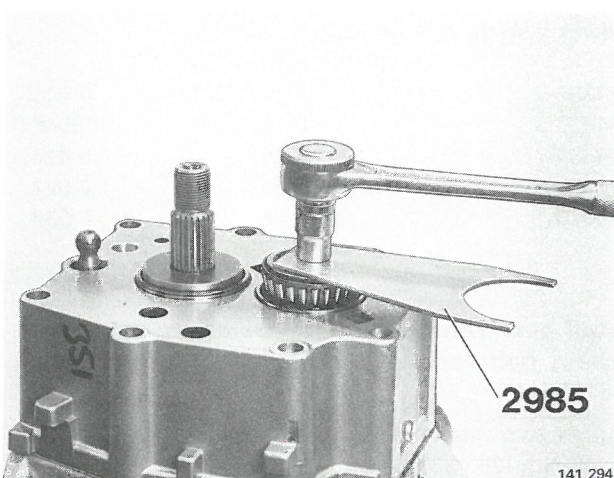
Countershaft should have an end float of 0.01–0.10 mm (0.0004–0.0040 in). If countershaft, any of its bearings, or the rear case/intermediate housing have been replaced the shim thickness must be determined.

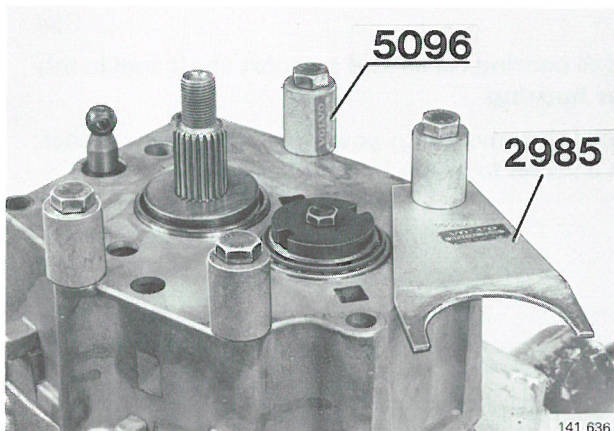
D56

Install rear countershaft bearing M 47 II:

Place support 2985 under nut when pressing bearing into position. Then install correct washer with old shim pack and tighten bearing to bottom.

Note: Make sure washer teeth align with gear teeth.



**Attach 5th gear housing**

Use shift bracket bolts and 4 × 5096 (B28-tools) as spacers.

D57

Install support 2985 on one of the bolts

Torque bolts to 35–50 Nm (26–37 ft lb).

D58

Position dial indicator

D59

Push up and turn shaft to set front bearing. Calibrate dial indicator zero

D60

Lower and turn shaft to set rear bearing. Read dial indicator

Note reading.

(If no play exists, select thinner shim.)

D61

Calculate thickness of countershaft shim

Permitted end float: 0.01–0.10 mm. (0.004–0.0040 in).

Example:	mm	in
Measured clearance	0.25	0.0098
Existing shim pack	+0.55	+0.0220
Total clearance	= 0.80	= 0.0318
Deduct end float	–0.01 to 0.10	–0.0004 to 0.0040
Shim thickness	= 0.70 to 0.79	= 0.0278 to 0.0314

Select shim thickness 0.75 mm (0.030 in).

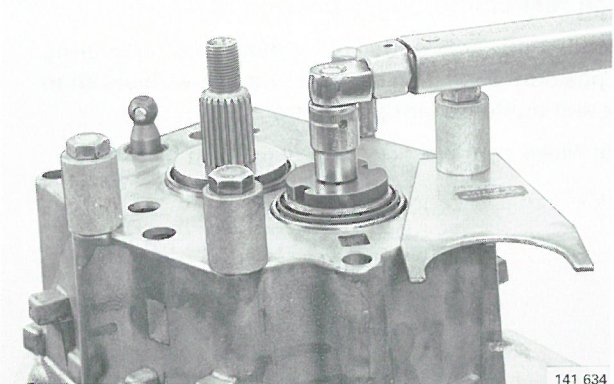
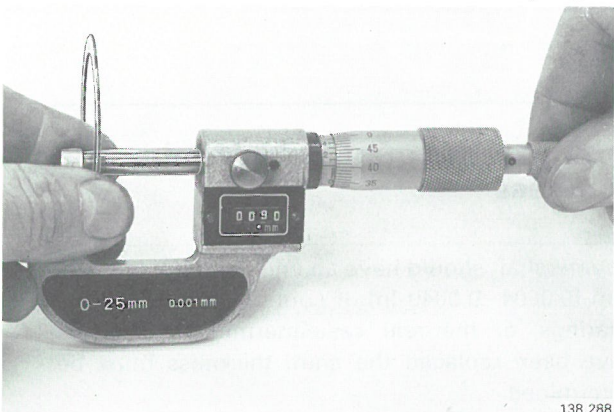
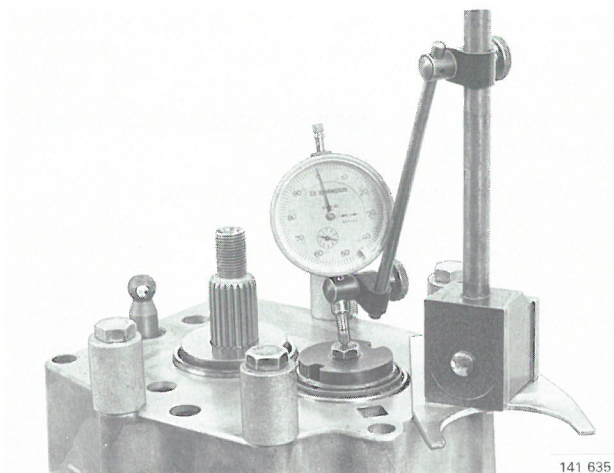
Following shim thicknesses are available

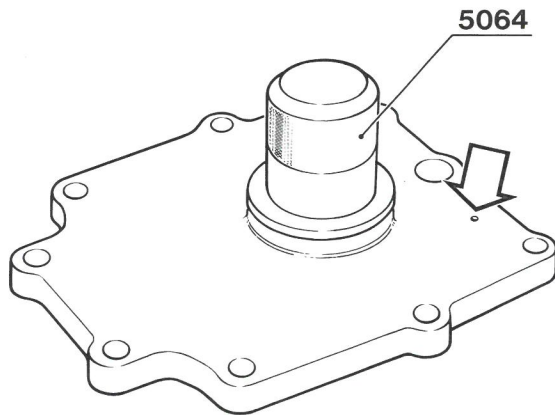
P/N	mm	in
3294334-2	0.10	0.004
3294335-9	0.15	0.006
3294336-7	0.25	0.010
3204069-3	0.55	0.022
3204070-1	0.75	0.030

D62

Install new shim pack, washer and a new self-locking bolt, or use thread locking compound 1161053-2

Engage two gears to lock transmission. Torque to: 35–45 Nm (25–32 ft lb).





Installing rear end cover

D63

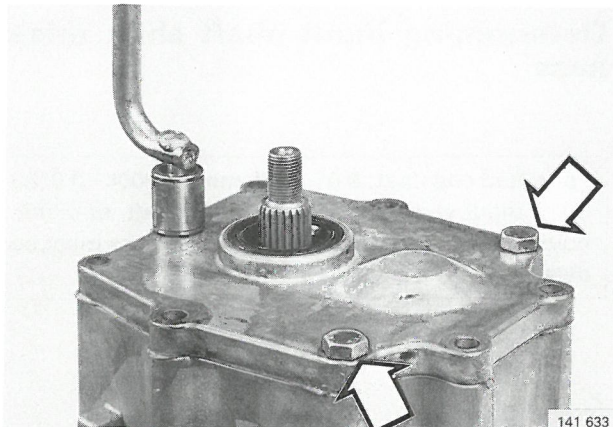
Make sure vent hole is not blocked

D64

Install seal in rear end cover

Grease and install output shaft seal. Use drift **5064**.

Seal should be positioned **2,5 mm** (0.1 in) inside flange.



D65

Grease housing face and position gasket

D66

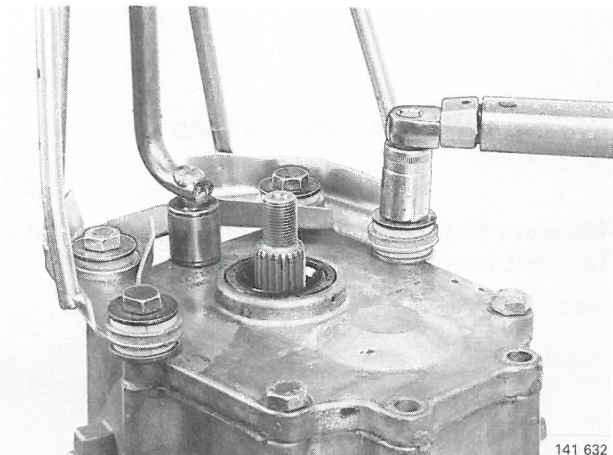
Use two bolts to attach rear end cover

D67

Attach gear selector rod

Grease and install rubber ring in joint. Use sleeve to lock pins.

D68



Install selector bracket

Note: Bolt – washer – spacer tube – washer.

Torque bolts to 35–50 Nm (25–35 ft lb).

D69

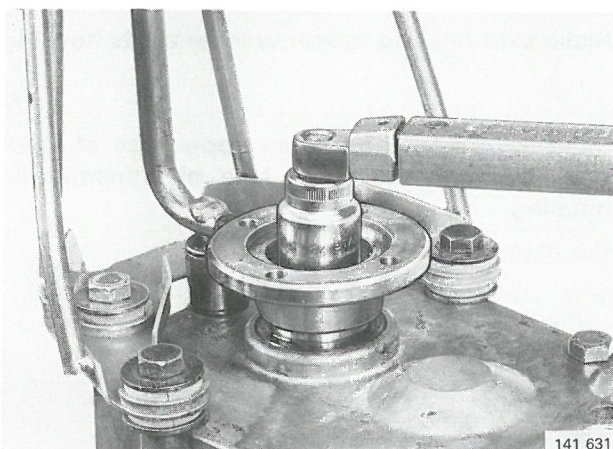
Install drive flange

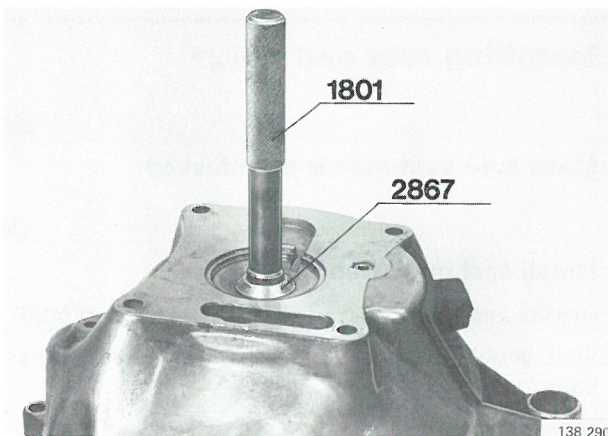
Torque nut to:

Bolt M16 **70–90 Nm** (50–60 ft lb)

Bolt M20 **90–110 Nm** (65–80 ft lb)

Engage two gears to lock transmission.





D70

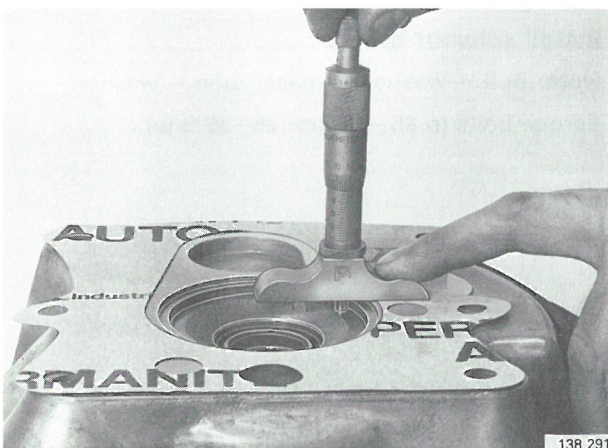
Grease and install seal in bell housing

Make sure pipe is at bottom.

Use drift **2867** and standard handle **1801**.

Determining input shaft shim thickness

Permitted end float: **0.01–0.20 mm.** (0.0004–0.0080 in). If input shaft, bearing on input shaft, or clutch housing has been replaced, shim thickness must be determined.



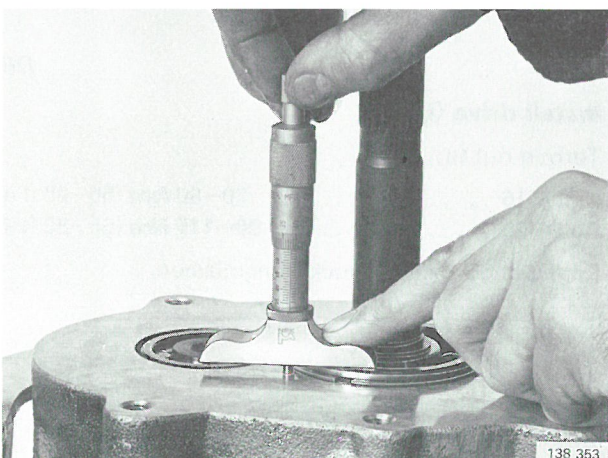
D71

Position gasket on clutch housing

D72

Measure distance between gasket top and bearing seat bottom

Note distance



D73

Make sure bearing spacer washer abuts housing

D74

Measure distance between upper face of input shaft bearing and front face of transmission housing

Use depth micrometer and note reading.

D75

Calculate input shaft shim thickness

Permitted end float: **0.01–0.20 mm.** (0.0004–0.0080 in).

Example:

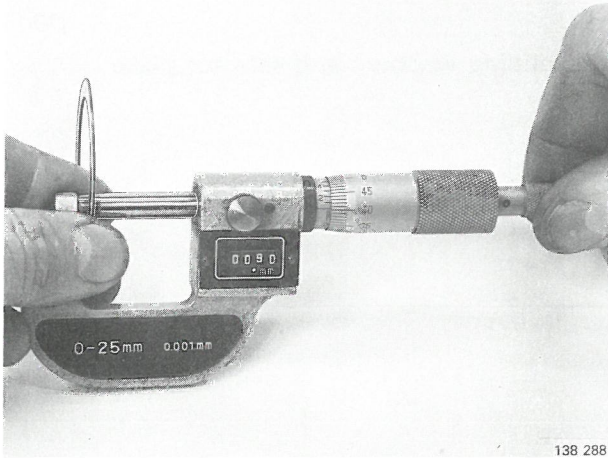
Distance:	mm	in
– gasket face to bearing seat	5.80	0.2283
– bearing to housing	–4.85	–0.1909
	=0.95	=0.0374
Deduct end float	–0.01	–0.0004
	to 0.20	to 0.0080

Calculated shim thickness	=0.75	=0.0294
	to 0.94	to 0.0370

Select shim thickness **0.90 mm.** (0.036 in).

Following shim thicknesses are available:

P/N	mm	in
3292838-4	0.25	0.010
948008-8	0.60	0.024
948009-6	0.75	0.030
948010-4	0.90	0.036
948011-2	1.00	0.040



138 288

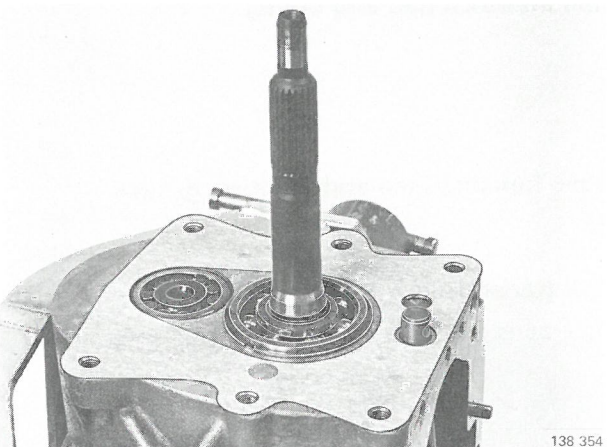
D76

Grease transmission gasket face and position gasket

D77

Position shim in clutch housing

Apply grease to hold shim in position.



138 354

D78

Install bell housing

Torque to **35–50 Nm** (25–35 ft lb).

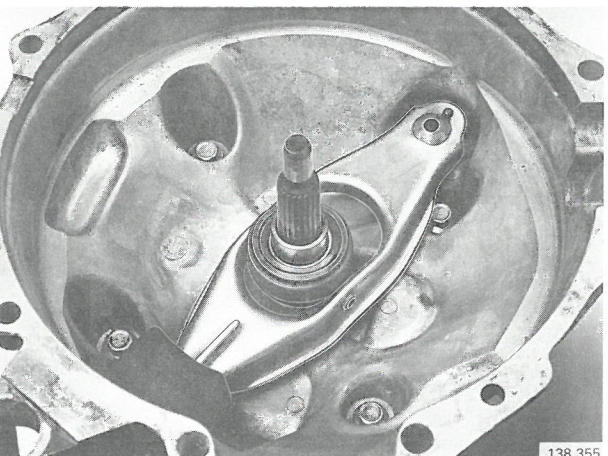
D79

Install clutch release fork, washer and release bearing

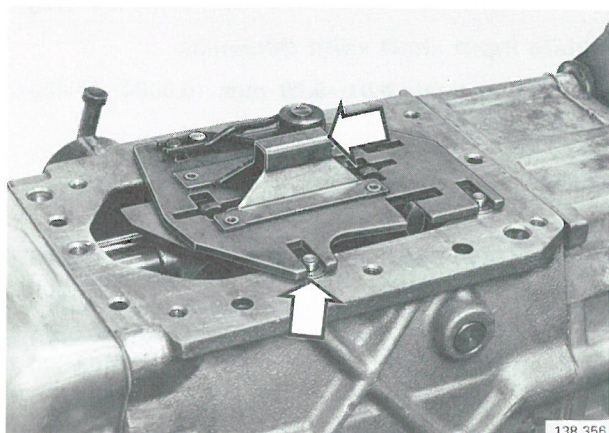
First apply grease to bearing sliding surface and ball joint.

Sparingly apply grease to splines.

Do not forget to place washer beneath ball

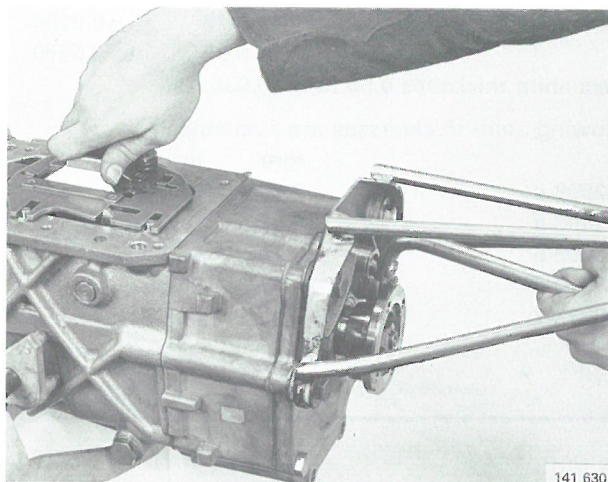


138 355



D80

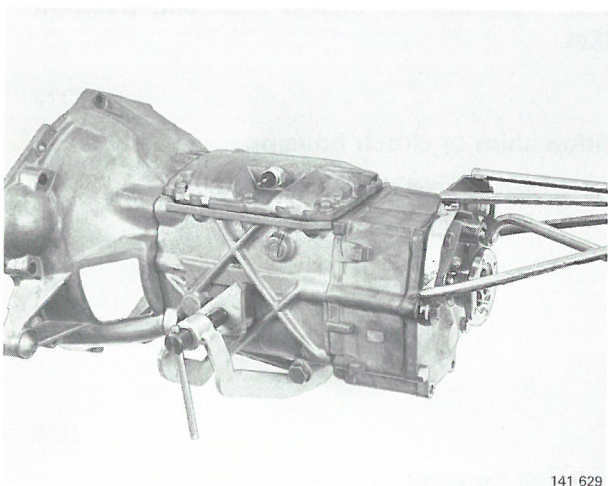
Install sliding washers and selector plate



D81

Check function

Move selector plate by hand to check that all gears can be engaged and disengaged.



D82

Install interlock ball and spring

D83

Grease housing face and position gasket

D84

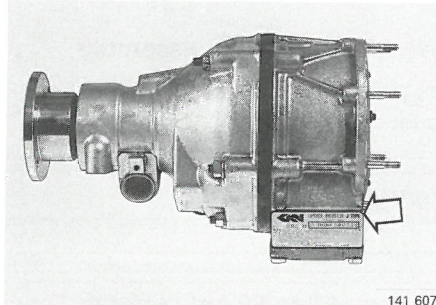
Install transmission cover

Torque bolts to 15–25 Nm (11–20 ft lb).

E. Disassembling Type J and Type P, overdrives

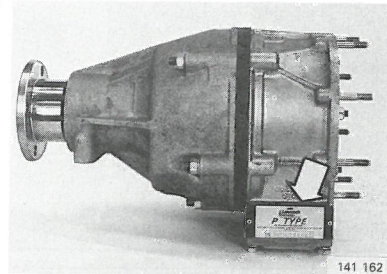
Special tools: 2836, 5069, 5103, 5149, 5172,
5183, 5210, 5303, 5304, 5973,

Type J



141 607

Type P



141 162

Disassembling

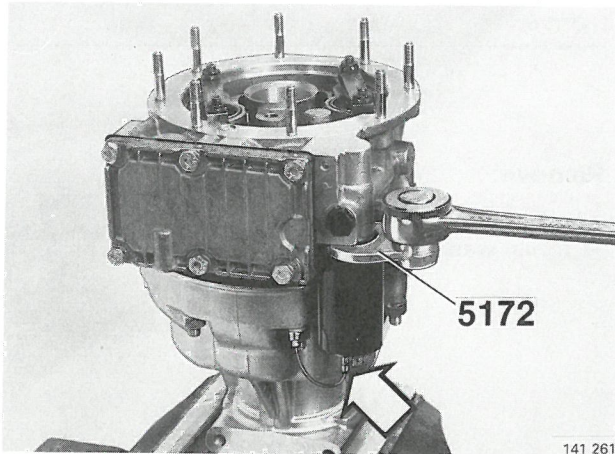
E1

Clamp overdrive rear end in a vice protected by soft jaws

E2

Remove solenoid valve

Use crow-foot wrench **5172**. Disconnect ground wire.



141 261

E3

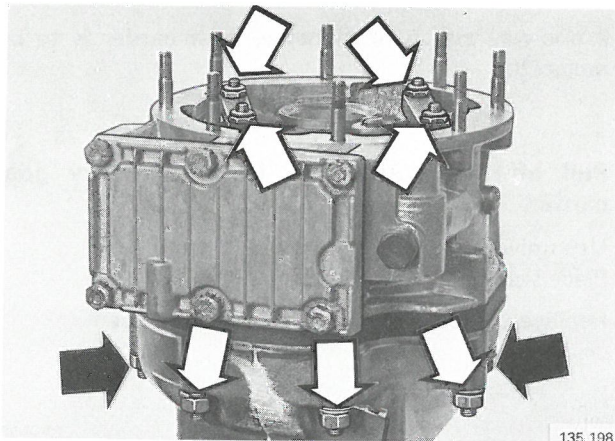
Remove:

- bridges.
- front and rear housing nuts

Note: Last two nuts removed should be opposite each other. Loosen the nuts stepwise.

E4

Remove front housing assembly

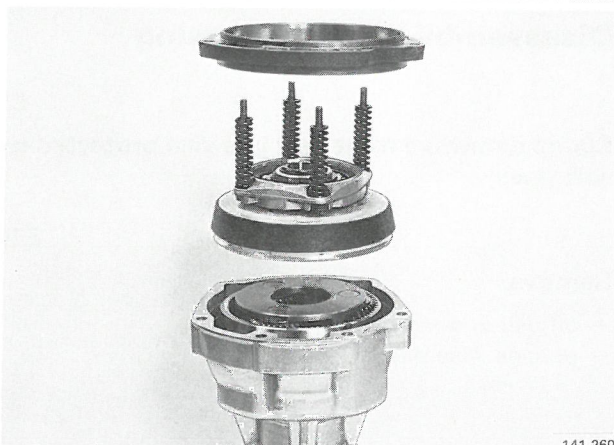


135 198

E5

Remove:

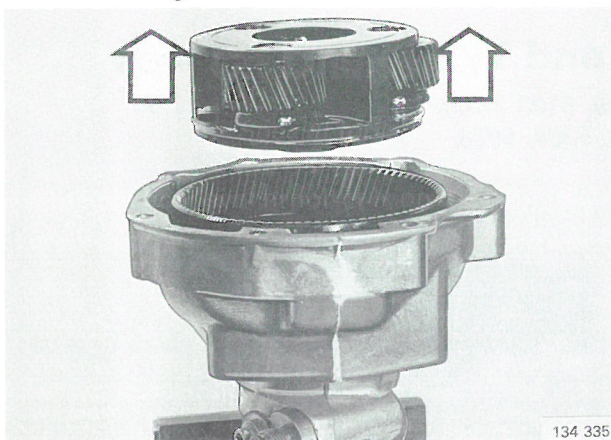
- brake drum
- springs. Lift out clutch, thrust bearing and sun gear assembly.



141 260

Type P: Proceed to operation E7.

Disassembling



Operation E6 only applies to Type J. Overdrive.

E6

Remove planetary gear assembly

Replace planetary gear assembly if gears or carrier are damaged.

Proceed to operation E9.

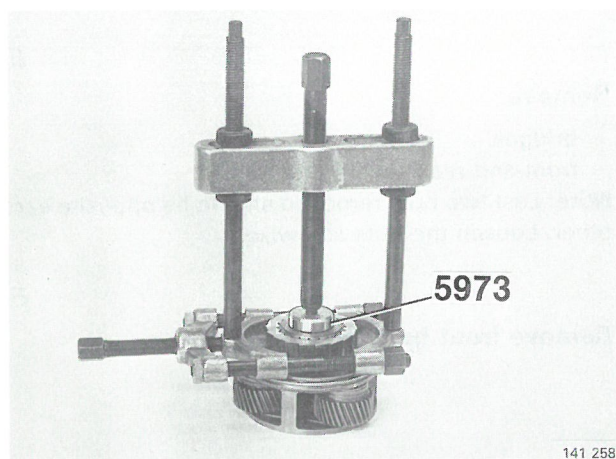


Operations E7 to E8 only refer to Type P Overdrive.

E7

Remove:

- planetary gear carrier
- thrust washer



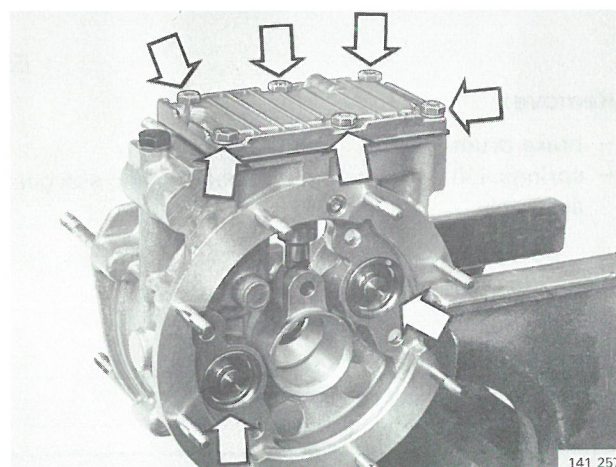
If one-way clutch or planetary gear carrier is to be replaced:

E8

Pull off one-way clutch from planetary gear carrier

Use universal type puller.
Place washer **5973** under puller spindle.

Replace planetary gear assembly if damaged



Disassembling front housing

E9

Clamp overdrive front part in a vice protected by soft jaws

E10

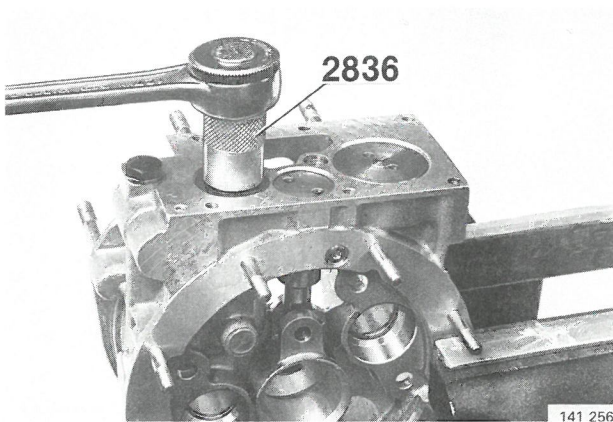
Remove:

- oil pan and strainer
- pistons. Use pliers.

E11

Remove oil filter plugs, check valve and relief valve

Use plug wrench **2836**. Tap plugs with a plastic mallet to facilitate removal.

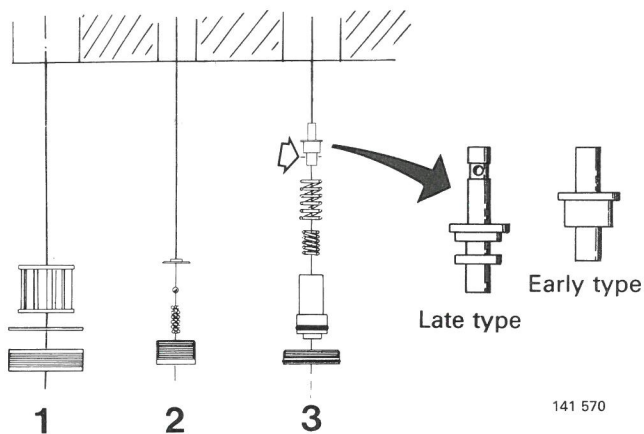


E12

Remove:

1. Oil filter
2. Check valve and spring, ball and seat
3. Relief valve assembly. (If replacing, always use new type relief valve).

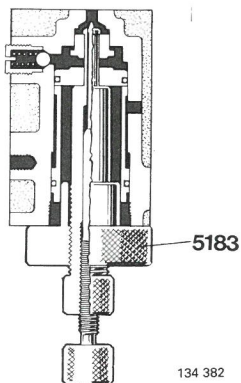
Examine relief valve piston. If scored, it will damage O-ring. Replace relief valve assembly.



E13

Withdraw cylinder and relief valve seat

Use extractor **5183**.

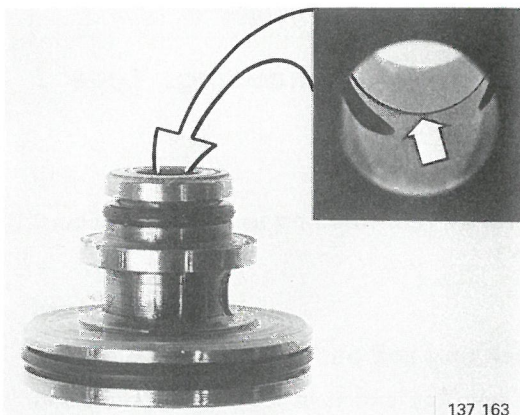


E14

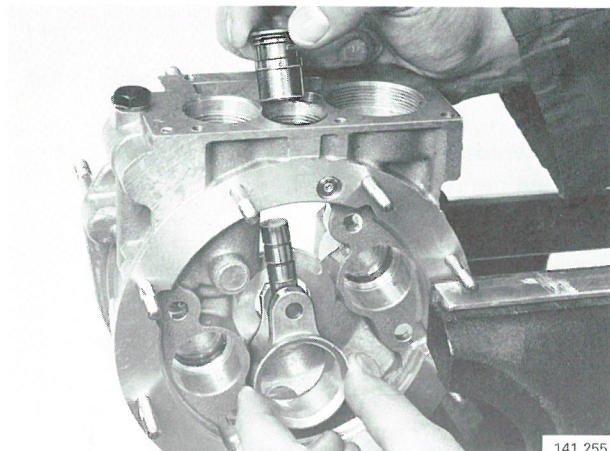
Examine relief valve

If engagement valve is slow or if overdrive slips on engagement, it is particularly important to check following.

Check valve seat. If there are signs of wear, replace relief valve assembly.

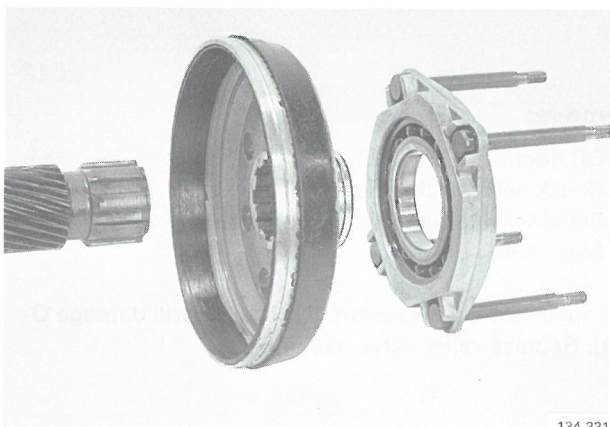


Disassembling



E15

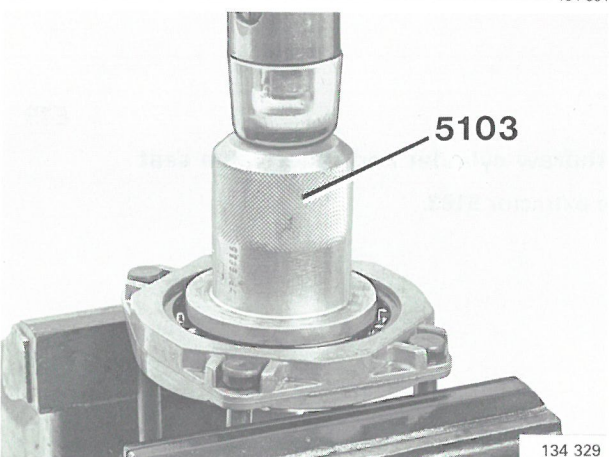
Remove cylinder and pump piston



E16

Disassembling clutch assembly

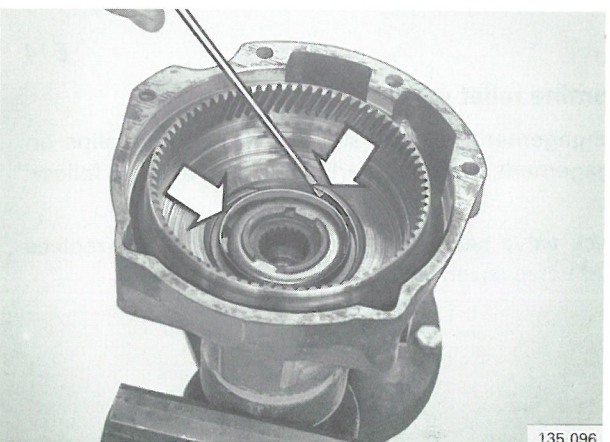
Remove lock ring. Pull out sun gear and clutch disc from bearing carrier



E17

Remove lock ring. Tap out bearing from carrier.
Use drift 5103.

Type P: Proceed to operation E22.



Operations E18 to E21 only refer to Type J.

Disassembling rear housing. Type J Overdrives

E18

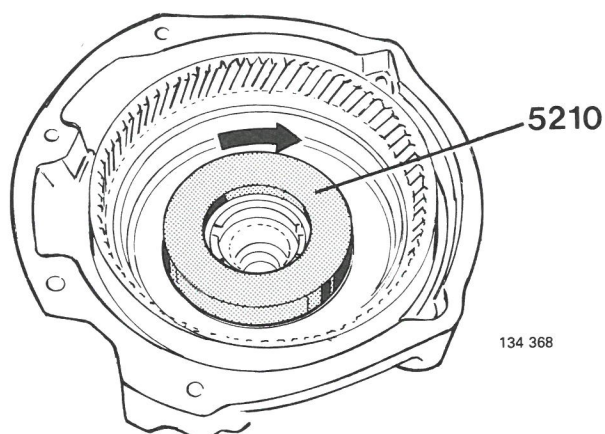
Clamp overdrive rear housing in a vice protected by soft jaws

E19

Remove lock ring and one-way clutch oil slinger

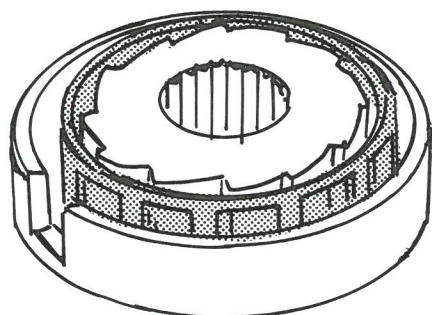
Note: Turn one-way clutch in locking direction and make sure that outer ring does not slip on input shaft.

E20

**Remove one-way clutch**

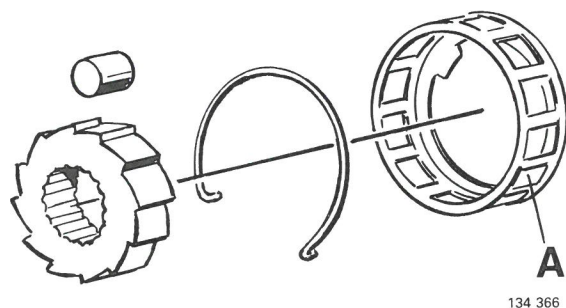
Use ring 5210. Turn ring clockwise

E21

**Examine roller cage**

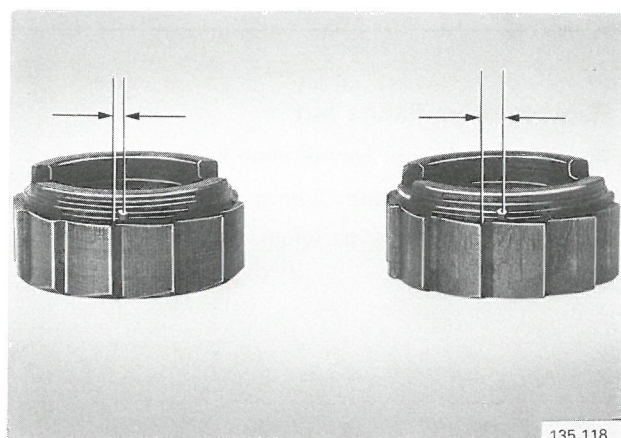
Invert ring with one-way clutch in it. Check to see if roller cage is oval. If so, replace with new type, Volvo P/N 1 209 726-7.

E22

**Disassemble one way clutch**

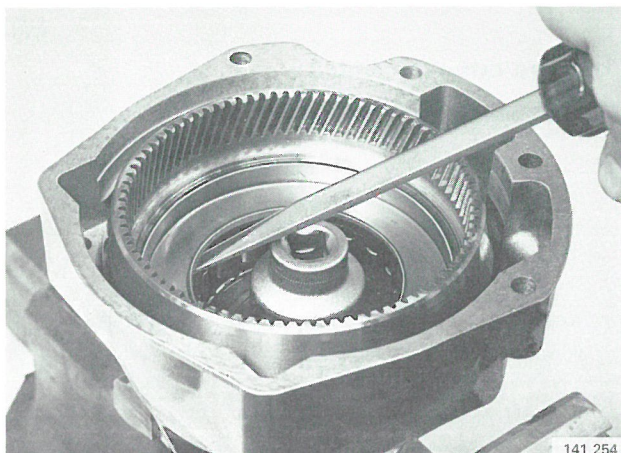
Note Illustrations show an early version of one-way clutch.

Replace any damaged parts.



If early type one-way clutch is fitted, replace it with new type: Volvo P/N 1 209 484-3. (Location of lock spring hole is new.) See illustration.

Proceed to operation E26



Operations E 22 to E 25 only refer to Type P.

Disassembling rear housing, Type P, Overdrive

Clamp overdrive rear housing in a vice protected by soft jaws

E23

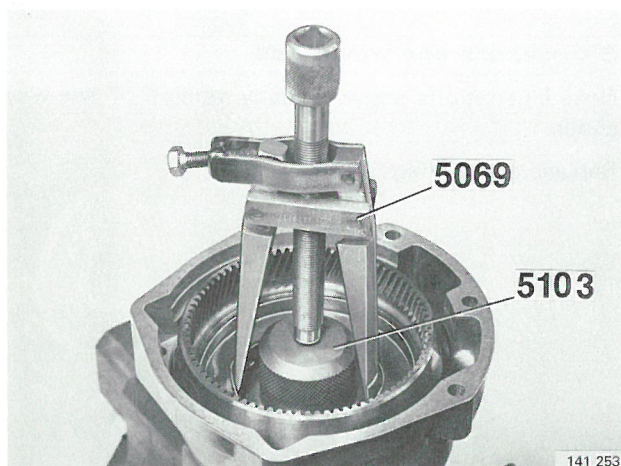
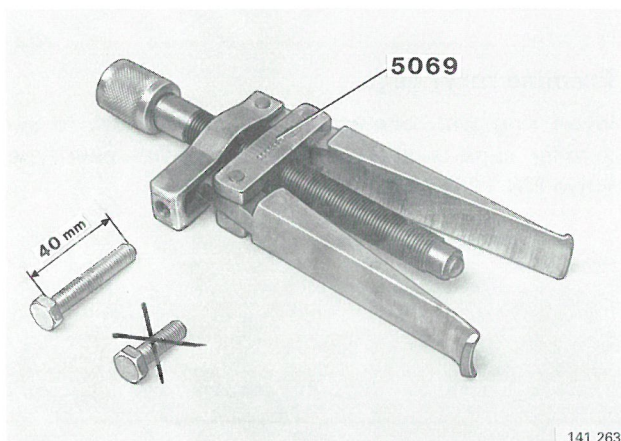
Pry up oil slinger in two places to install puller 5069.

Place a socket on hub. Use a screwdriver to pry up oil slinger.

E24

Modification to tool 5069

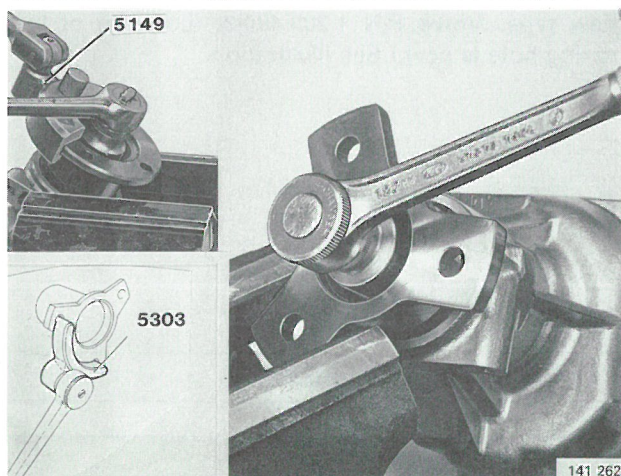
Replace center bolt with a 40 mm long bolt, threaded along entire length. P/N 998 9709.



E25

Place drift 5103 (group 21 tool) in bottom of housing. Use puller 5069 to draw out oil slinger.

Remove roller cage.



E26

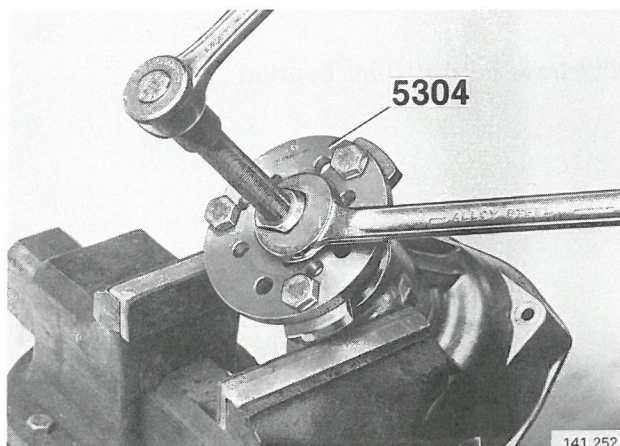
Remove drive flange nut

Round drive flange: Use wrench 5149 to hold.

Three-arm drive flange: Clamp drive flange in a vice.

Note: Use wrench 5303 when removing drive flange from vehicle.

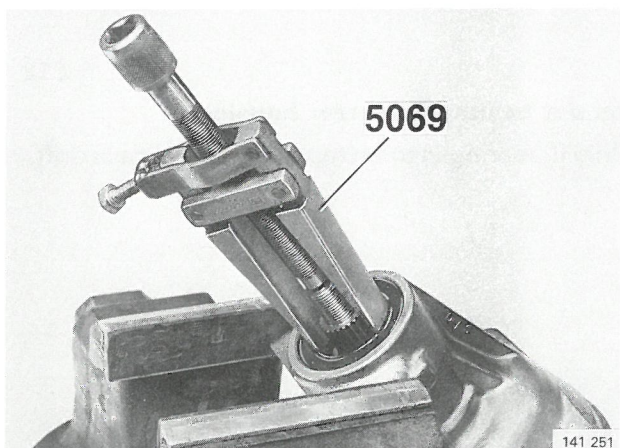
E27



Withdraw drive flange

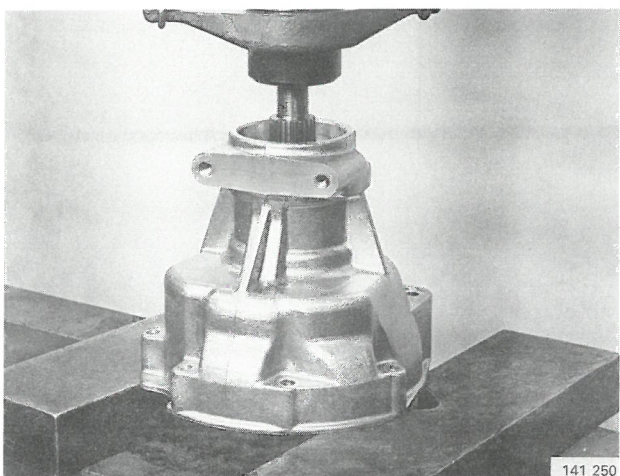
Use puller **5304** if required.

E28



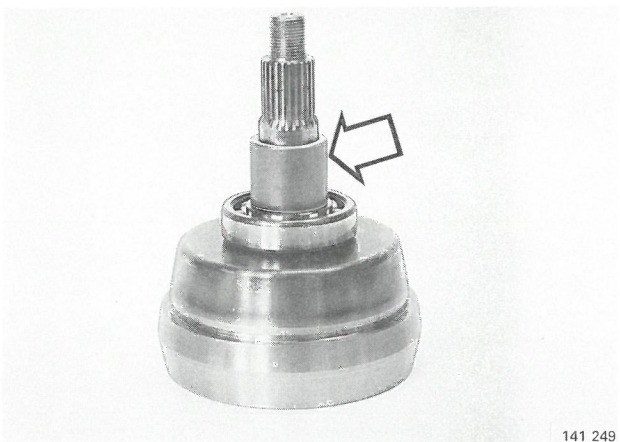
Remove oil seal with puller 5069.

E29



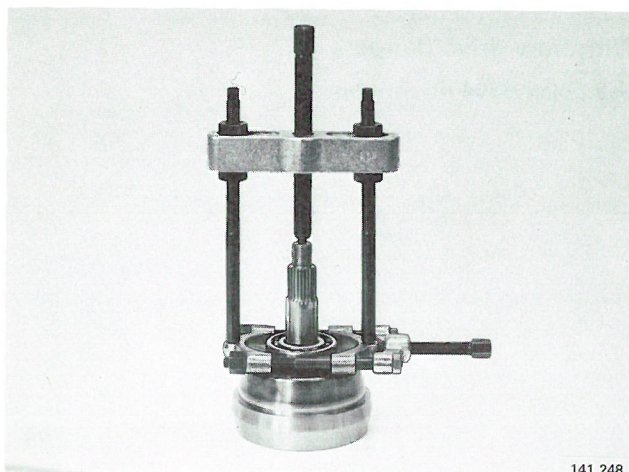
Press out output shaft

E30



Remove spacer sleeve

(On Type J: speedometer drive gear.)



Withdraw output shaft bearing

E31



Tap out bearing from rear housing

(Only if bearing is to be replaced.) Use brass drift.

E32

F. Examining overdrive

Cleaning and checking

Check:

- that control orifice drilling between relief valve and solenoid is free from dirt. If it is not possible to blow-clean, use a pointed matchstick. Do not attempt to clean the orifice with wire or its calibration may be impaired.
- that groove in front of ring gear in output shaft is thoroughly clean. (Dirt collects here as a result of centrifugal force.) Clean all parts and check carefully for signs of wear, cracks or other damage. Check following carefully:
 - that filter is undamaged
 - operating pistons for scores or wear
 - valves for wear
 - all gear wheels and bearings for cracks and wear.

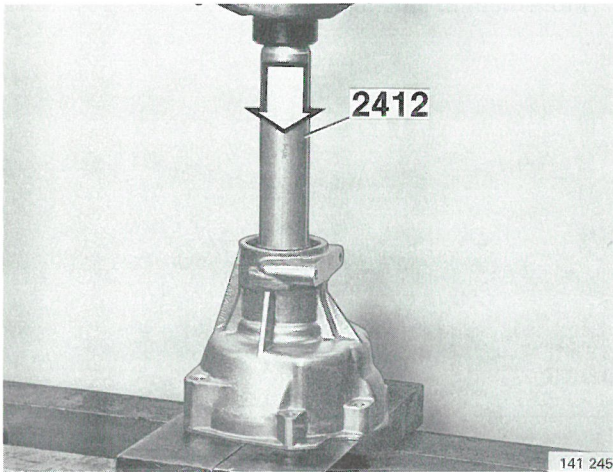
Check:

- that clutch return spring is 55.5 ± 1.5 mm (2.1852 0.060 in) long
- that springs are not misshaped or cracked
- brake ring for cracks, scores, wear etc.
- cone clutch for signs of burning or wear
- solenoid by means of a 12 volt battery and an Ammeter. Power consumption = 1.5–2.0A. Check movement of solenoid plunger.

G. Assembling Type J and Type P overdrives

Special tools: 1845, 2412, 2806, 2834, 2835, 2836, 5149, 5172, 5210, 5308

Use new gaskets, O-rings and seals when assembling overdrive. Observe utmost cleanliness since the hydraulic system is very sensitive to dirt.

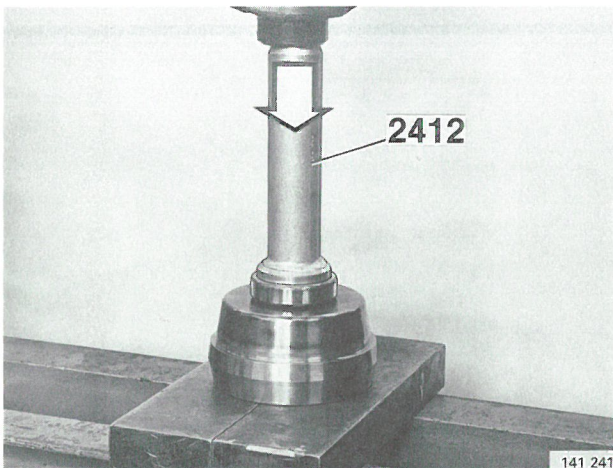


Assembling rear housing

G1

Press bearing in rear housing

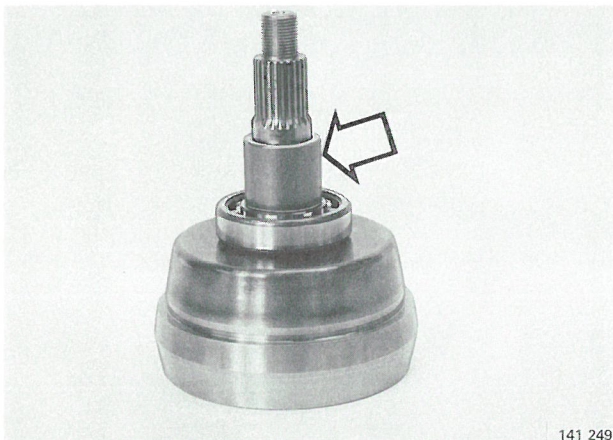
Use drift 2412.



Press on bearing on output shaft

G2

Use drift 2412.

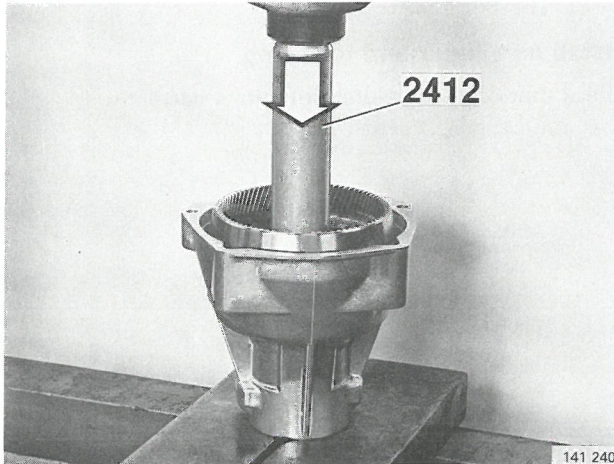


Install spacer sleeve on output shaft

G3

(On Type J: speedometer drive gear.)

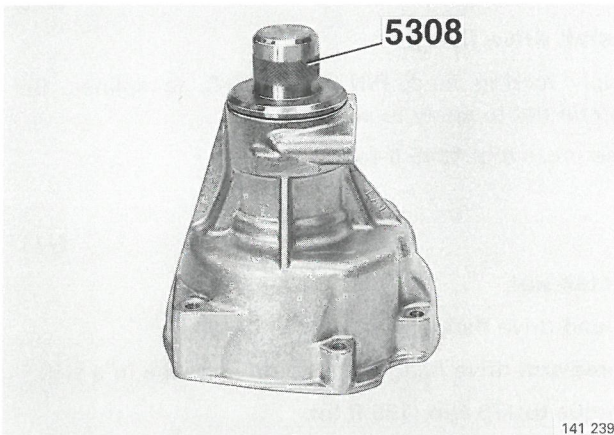
G4



Press output shaft in rear housing

Use drift 2412.

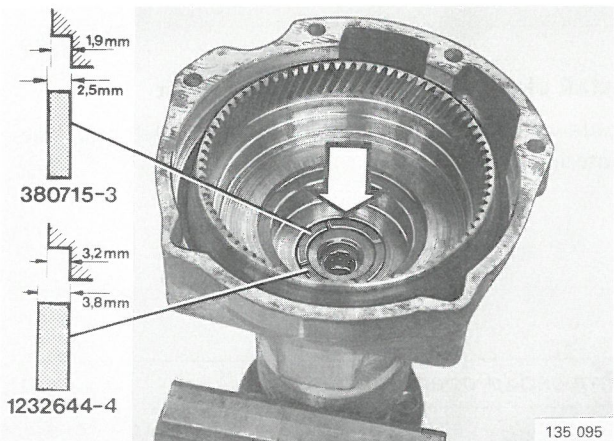
G5



Tap oil seal into rear housing

Use drift 5308.

Type P: Proceed to operation G13.



Operations G6 to G12 only refer to Type J.

Before installing one-way clutch:

G6

Make sure thrust washer is correctly positioned

If thrust washer is replaced, make sure that it is correctly positioned. It should be 0.6 mm (0.024 in) above edge.

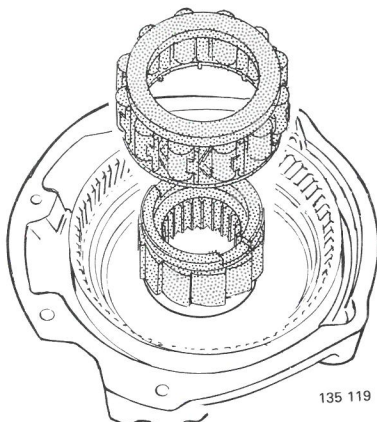
G7

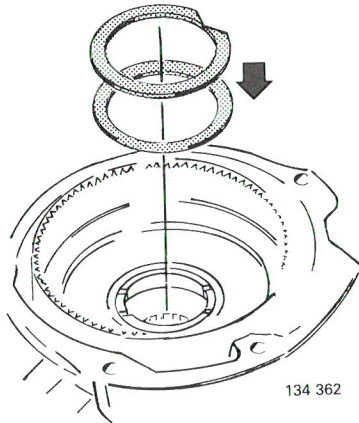
Correct thrust washers:

- Use thickness 2.5 mm (0.1 in), P/N 380 715-3, for early version of output shaft, P/N 380 679-1 and P/N 1 232 105-5.
- Use thickness 3.8 mm (0.15 in), P/N 1 232 644-4, for output shaft P/N 1 232 646-3.

G8

Install one-way clutch hub and roller cage with rollers

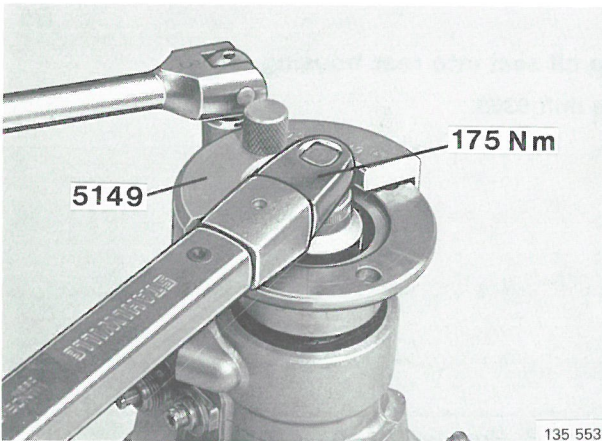




G9

Install oil slinger and lock ring

Check that one-way clutch functions correctly.



G10

Install drive flange

Apply locking fluid, P/N 1 161 075-5, to splines. Be careful not to apply to seal.

Use press tool 1845 if required.

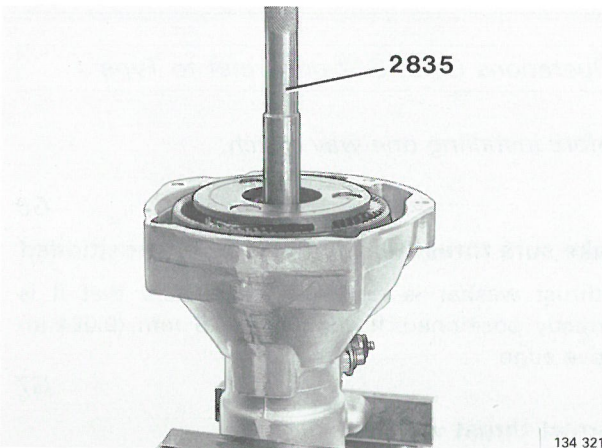
G11

Install nut

Round drive flange: use wrench 5149.

Three-arm drive flange: clamp drive flange in a vice.

Torque to 175 Nm (130 ft lb).

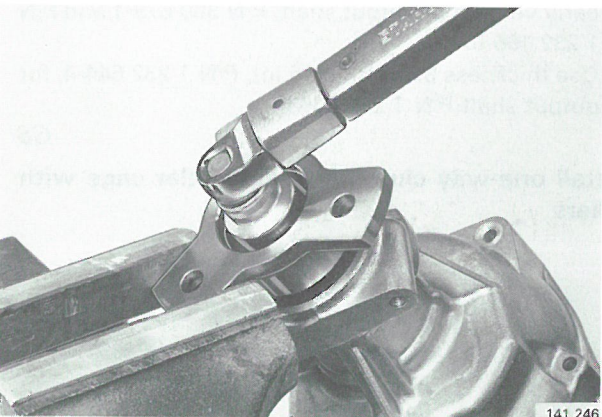


G12

Install planetary gear on output shaft

Guide splines into carrier and one-way clutch hub. Use centering drift 2835.

Proceed to operation G 18.



Operations G13 to G17 only apply to Type P.

G13

Install drive flange

Apply locking compound, P/N 1 161 075-5, to splines. Be careful not to apply to seal. Use press tool 1845 if required.

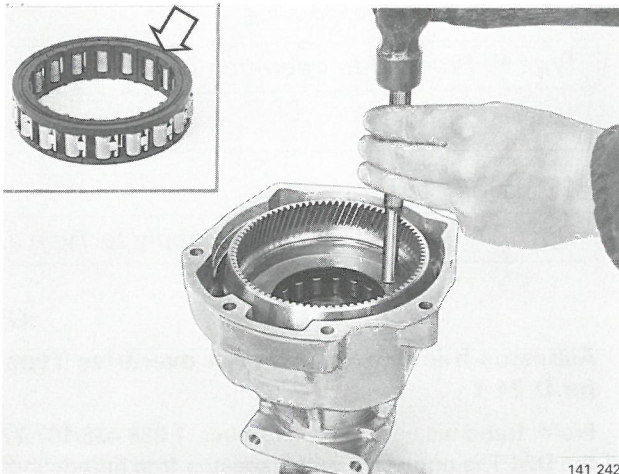
G14

Install nut

Round drive flange: use wrench 5149.

Three-arm drive flange: clamp drive flange in a vice. Torque to 175 Nm (130 ft lb).

G15



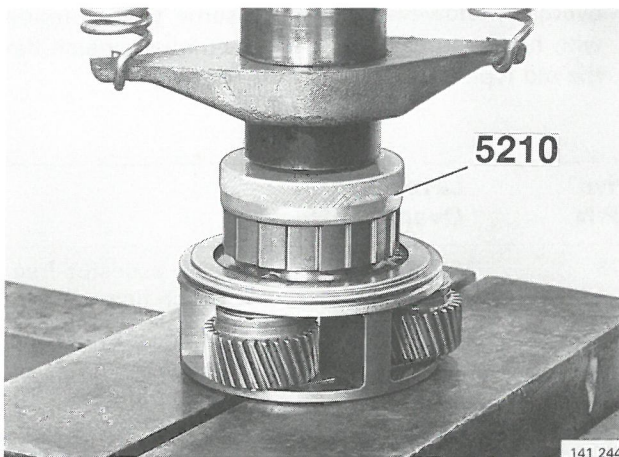
141 242

Position roller cage for one-way clutch

Groove on roller cage should face UP.

Use a drift to tap in oil slinger.

G16



141 244

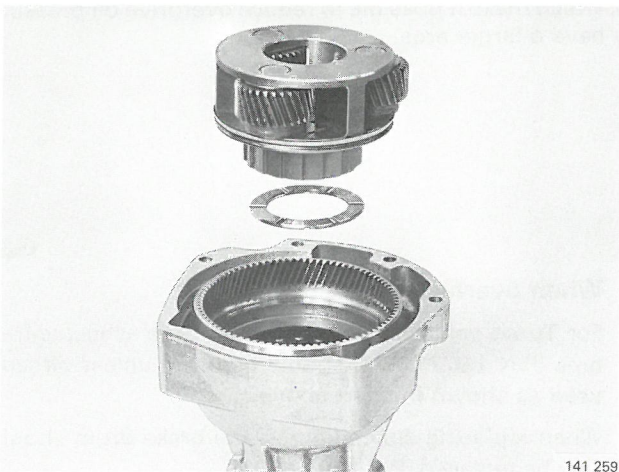
Press one-way clutch hub on to planetary gear carrier

Wipe off splines.

Bevelled edge on hub should face DOWN.

Use ring **5210** when pressing.

G17

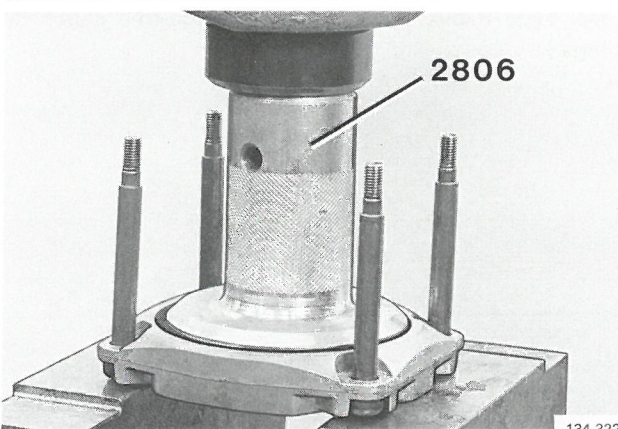


141 259

Install:

- brass thrust washer
- planetary gear carrier

G18



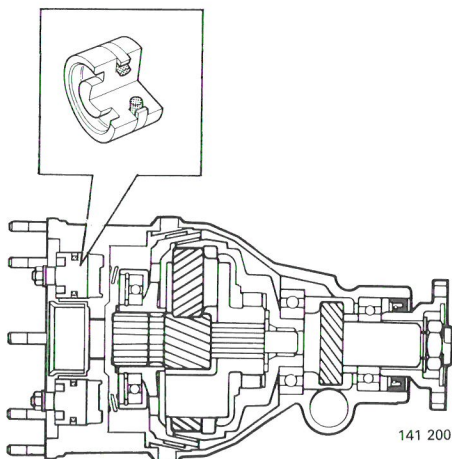
134 322

Installing clutch assembly

Press in bearing

Use drift **2806**. Attach lock ring

Type P: Proceed to operation G 21.



Operations G 19 to G 21 only apply to Type J.

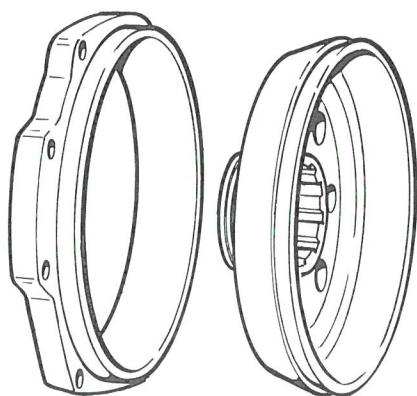
G19

Asbestos-free clutch linings in overdrive Type J for D 24 T

From transmission serial number 1 208 438/107 770, the D24 T is equipped with asbestos-free linings in the overdrive. However, there are some D 24 T models with higher transmission serial numbers which have the old type friction linings, see below.

Engine	Transmission serial number	Overdrive Volvo P/N	Laycock Overdrive No	
D24T	1 208 438/107 770-108 305	1 208 478	115 970	With asbestos-free clutch linings
D24T	1 208 438/108 306-	1 208 478 or	115 970	With asbestos-free clutch linings
		1 208 282	115 925	With old type clutch linings

The asbestos-free material has improved friction properties, which make it possible to reduce overdrive oil pressure to 2.8–3.1 MPa (400–440 psi). The new clutch linings also have a larger area.



380 910-0

1377039-1

141 604

G20

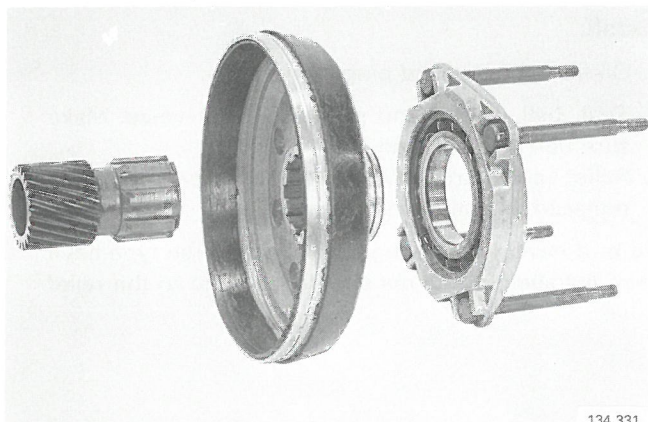
When overhauling

For Turbo vehicles, clutch linings of the asbestos-free type (P/N 1 377 039-1) should be used, unless already used as shown in chart above.

When replacing clutch linings, the brake drum should also be replaced. P/N 380 910-0.

(All Type P overdrives have asbestos-free clutch linings.)

G21



134 331

Dry clutch in a warm place

All moisture must be removed from the friction lining before the clutch is fitted to the front housing. When dry, oil lining with ATF type F or G.

G22

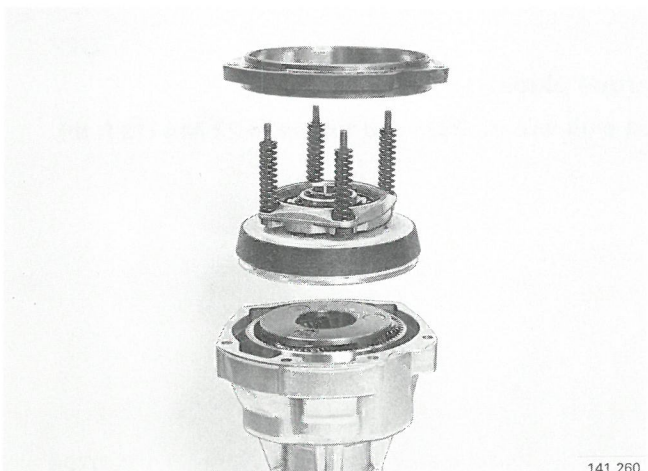
Install:

- sun gear
- clutch
- lock rings.

G23

Install:

- clutch assembly
- springs
- gasket between rear housing and brake drum. Make sure gasket is installed correctly.
- brake drum



141 260

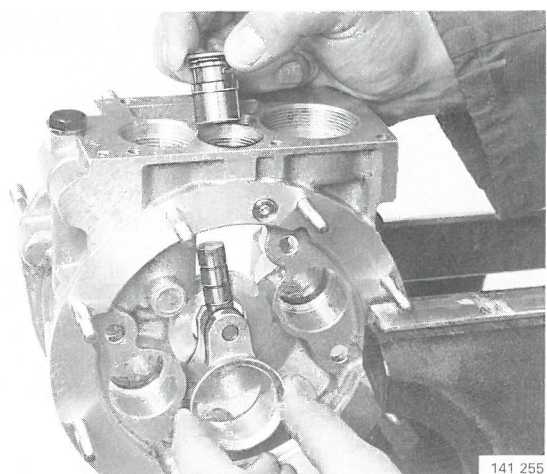
Assembling front housing

Prior to assembling, make sure front housing is carefully cleaned. The hydraulic system is very sensitive to dirt.

G24

Lubricate oil pump with ATF before fitting to front housing

Make sure that the groove and bevel on the pump plunger are aligned with the recess for the pressure filter. This prevents knocking noise from pump.



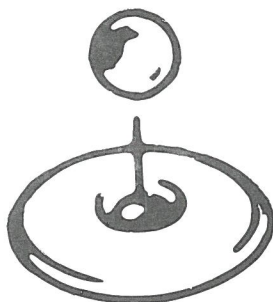
141 255

G25

Check non return valve seat for leakage

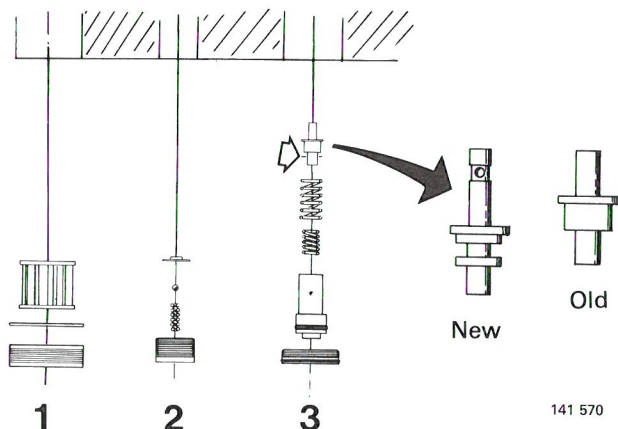
Blow through the valve to check for leakage. If the leakage is slight place the seat and steel ball on a flat surface and tap the ball with a plastic mallet. Recheck.

If the leakage is large the valve seat is probably too oval and therefore should be replaced. Make sure when fitting the valve that the steel ball is positioned correctly.



135 121

G26



Install:

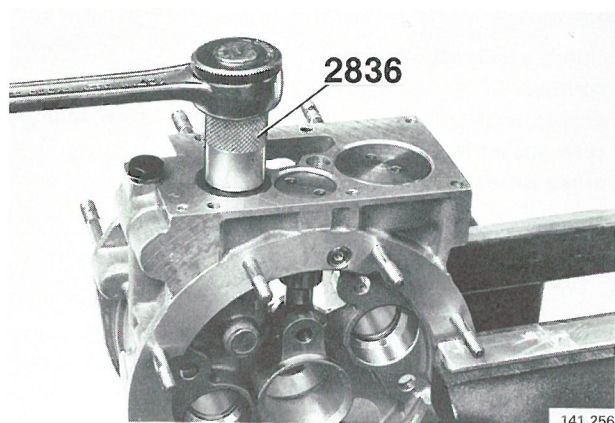
1. Oil filter, gasket and plug.
2. Seat, ball, spring and plug for check valve. Make sure ball is positioned correctly.
3. Relief valve parts. Always use new type if piston is replaced. Install shims, if applicable.

Note: If new clutch linings of asbestos-free type have been installed, no shims should be fitted to the relief valve.

G27

Torque plugs

Use plug wrench **2836** and torque to **22 Nm (16 ft lb)**.



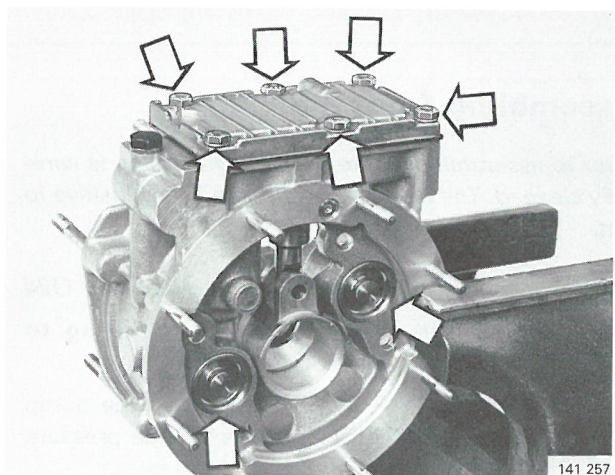
G28

Install oil pan

Install strainer and gasket.

Make sure magnet in oil pan is cleaned.

Torque bolts to 10 Nm (7 ft lb).



G29

Position clutch pistons in cylinders

Note: As a running modification during the Spring of 1985, 4 mm longer clutch pistons with a Teflon ring on the outside of the O-ring for improved sealing, have been installed. Pistons with O-rings should be replaced by new type pistons with Teflon ring, P/N 1 377 041-7.

G29

Assemble rear and front housings

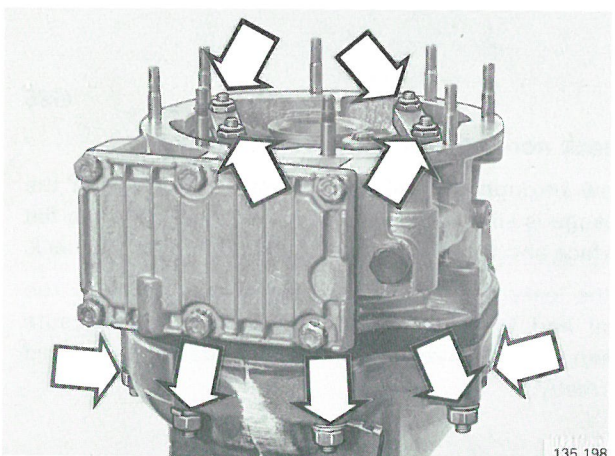
Note: Make sure gasket fitted between brake drum and rear housing is installed.

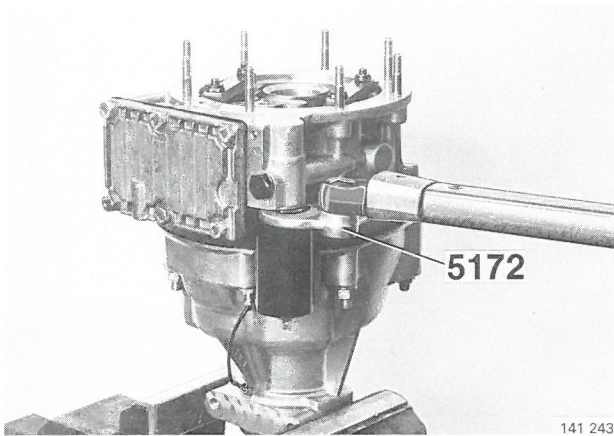
Remove remains of old nylon washers from two upper bolts on rear housing. Install new nylon washers, small end towards rear housing. Torque nuts in stages to 12 Nm (9 ft lb).

G30

Install bridges

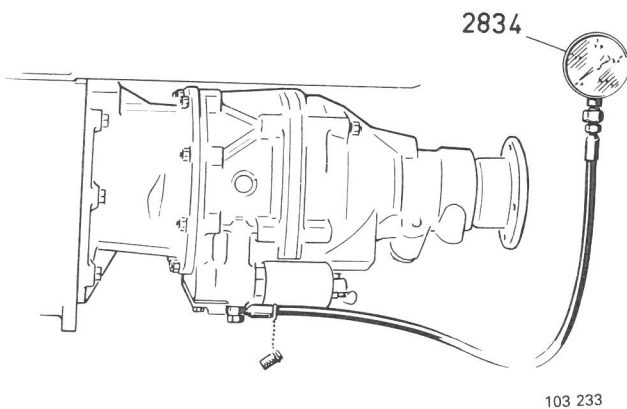
Torque nuts to 10 Nm (7 ft lb).



**Install solenoid. Attach ground wire.**Use crow-foot wrench **5172**.

Torque to 50 Nm (37 ft lb).

H. Testing oil pressure

Special tool: 2834

The oil pressure can be checked when driving on test rollers or highway.

Remove plug or switch below control valve and connect test gauge **2834**.

Drive in 4th gear, overdrive disengaged, speed 70 km/h (45 mph). Pressure should be approx. 0.15 MPa (21 psi).

Engage overdrive. Pressure should increase to:

Type J

D24T and Gasoline Turbo	Rebuilt with asbestos-free clutch linings	3.1–3.4 MPa (440–483 psi)
-------------------------	--	-------------------------------------

D24T	Originally with asbestos-free clutch linings (overdrive P/N 115 970)	2.8–3.1 MPa (400–440 psi)
------	---	-------------------------------------

Gasoline Turbo	With old type clutch linings	3.9–4.2 MPa (554–596 psi)
----------------	-------------------------------------	-------------------------------------

Re-maining	With old type clutch linings	3.7–4.0 MPa (525–568 psi)
------------	------------------------------	-------------------------------------

Type P

All		2.8–3.1 MPa (400–440 psi)
-----	--	-------------------------------------

Disengage overdrive and check time for pressure reduction to 0.15 MPa (21 psi).

Time must not exceed 3 seconds.

M 46 Transmission components

- 1 Needle bearing
- 2 2nd gear wheel
- 3 Synchronizer ring
- 4 Spring
- 5 Operating sleeve
- 6 Synchronizer hub
- 6a Washer
- 7 Sliding key ("dog")
- 8 Synchronizer ring
- 9 Lock ring
- 10 1st gear wheel
- 11 Damper
- 12 Spring
- 13 Brake cone
- 14 Drive flange
- 15 Needle bearing
- 16 Thrust washer (if not equipped with damper)
- 17 Sleeve
- 18 Input shaft
- 19 Needle bearing
- 20 Lock ring
- 21 Synchronizer ring
- 22 Spring
- 23 Operating sleeve
- 24 Synchronizer hub
- 25 Sliding key
- 26 Synchronizer ring
- 27 3rd gear wheel
- 28 Needle bearing
- 29 Main shaft
- 30 Lock ring
- 31 Intermediate shaft ("countershaft")
- 32 Reverse gear wheel
- 33 Stud shaft
- 34 Overdrive switch
- 35 Transmission (top) cover
- 36 Gasket
- 37 Spring
- 38 Selector plate
- 39 Pin
- 40 Engaging lug
- 41 Shift fork
- 42 Gear selector
- 43 Washer
- 44 Guide pin
- 45 Spring
- 46 Lock ring
- 47 Reverse gear selector
- 48 Selector shaft

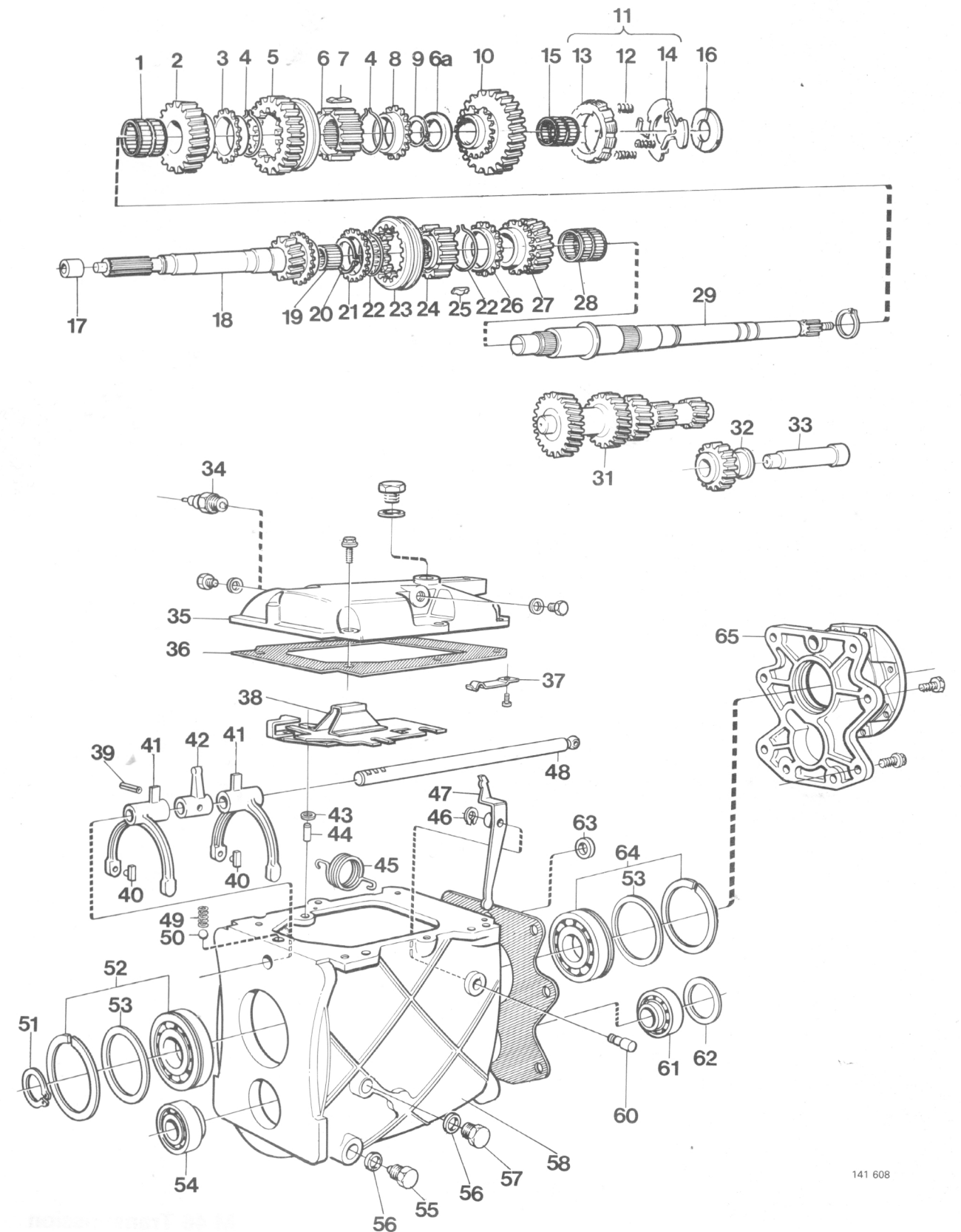
- 49 Spring
- 50 Interlocking ball
- 51 Lock ring
- 52 Ball bearing
- 53 Shim, thicknesses

P/N	mm	in
3292838-4	0.25	0.010
948008-8	0.60	0.024
948009-6	0.75	0.030
948010-4	0.90	0.036
948011-2	1.00	0.040

- 54 Roller bearing
- 55 Magnetic debris plug
- 56 Gasket
- 57 Plug
- 58 Transmission housing
- 59 Gasket
- 60 Stud shaft
- 61 Roller bearing
- 62 Shim, thicknesses

P/N	mm	in
949048-3	0.05	0.002
948298-5	0.10	0.004
948299-3	0.15	0.006
948300-9	0.35	0.014
948301-7	0.50	0.020
948302-5	0.70	0.028
948303-3	1.00	0.040

- 63 Seal
- 64 Ball bearing
- 65 Intermediate housing



M 47 Transmission components

- 1 Rear end cover
2 Seal
3 Top cover
4 Gasket
5 Spring
6 Selector plate
7 5th gear housing
8 Gasket
9 Roller bearing
10 Bearing outer race
11 Speedometer drive gear
12 Bearing outer race
13 Bearing inner race
14 Shim, thicknesses:

P/N	mm	in
3294334-2	0.10	0.004
3294335-9	0.15	0.006
3294336-7	0.25	0.010
3204069-3	0.55	0.022
3204070-1	0.75	0.030

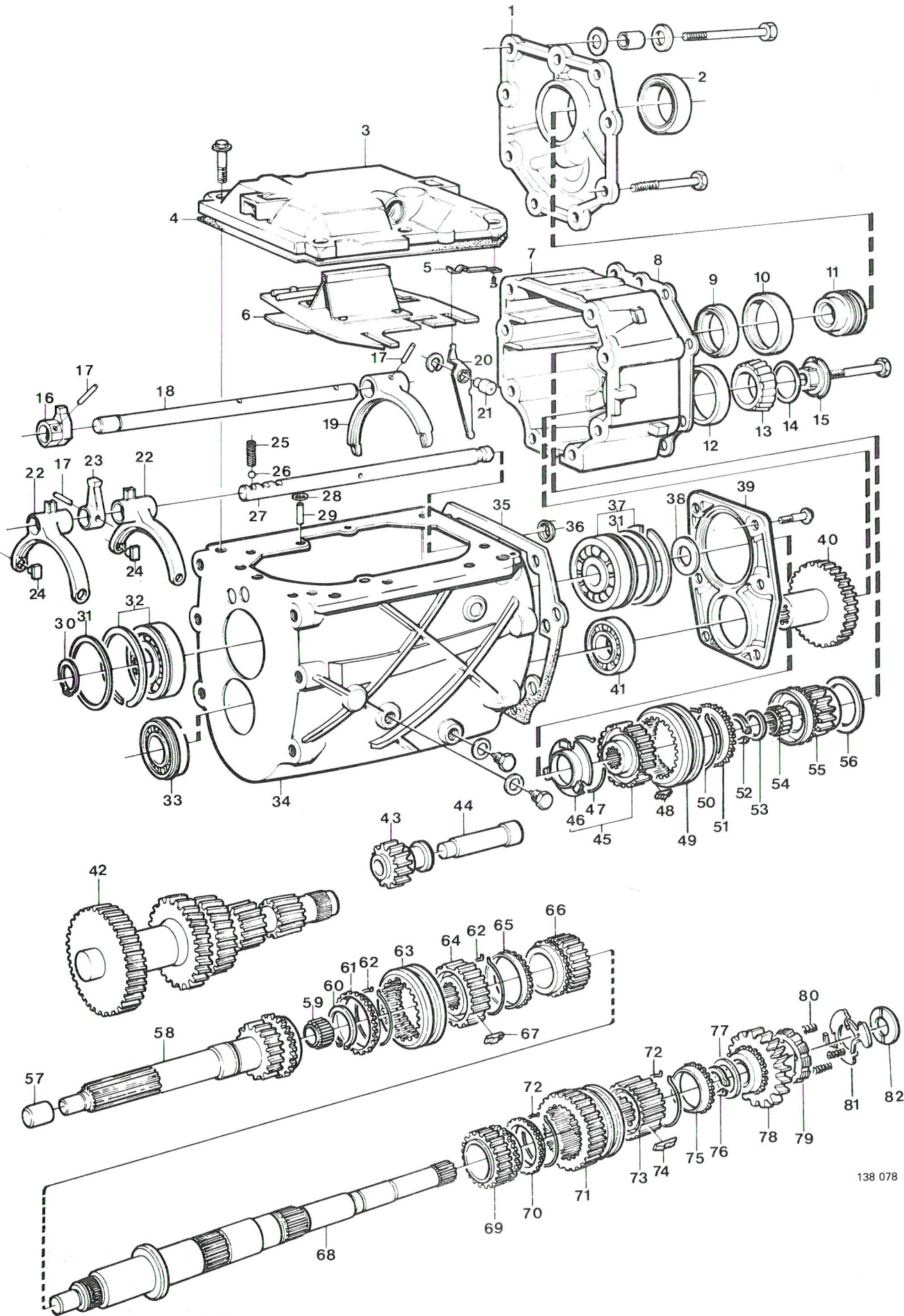
- 15 Washer
16 Gear selector
17 Pin
18 Selector shaft
19 Shift fork
20 Reverse gear selector
21 Stud shaft
22 Shift fork
23 Gear selector
24 Engaging lug
25 Spring
26 Interlocking ball
27 Selector shaft
28 Sliding washer
29 Guide pin
30 Lock ring
31 Shim, thicknesses:

P/N	mm	in
3292838-4	0.25	0.010
948008-4	0.60	0.024
948009-6	0.75	0.030
948010-4	0.90	0.036
948011-2	1.00	0.040

- 32 Ball bearing
33 Roller bearing
34 Transmission housing
35 Gasket
36 Seal
37 Ball bearing
38 Shim, thicknesses:

P/N	mm	in
34615-5	0.10	0.004
120116-9	0.15	0.006
34614-8	0.35	0.014
947120-2	0.50	0.020

- 39 Bearing holder
40 Drive gear
41 Roller bearing
42 Intermediate shaft
43 Reverse gear wheel
44 Stud shaft
45 Synchronizer hub
46 Drive flange
47 Spring
48 Sliding key ("dog")
49 Operating sleeve
50 Spring
51 Synchronizer ring
52 Lock ring
53 Spacer
54 Needle bearing
55 5th gear wheel
56 Spacer
57 Sleeve
58 Input shaft
59 Needle bearing
60 Lock ring
61 Synchronizer ring
62 Spring
63 Operating sleeve
64 Synchronizer hub
65 Synchronizer ring
66 3rd gear wheel
67 Sliding key
68 Main shaft
69 2nd gear wheel
70 Synchronizer ring
71 Operating sleeve
72 Spring
73 Synchronizer hub
74 Sliding key
75 Synchronizer ring
76 Lock ring
77 Washer
78 1st gear wheel
79 Damper cone
80 Spring
81 Drive flange
82 Thrust washer (if not equipped with damper)



M 47 II Transmission components

- 1 Rear end cover
- 2 Seal
- 3 Top cover
- 4 Gasket
- 5 Spring
- 6 Selector plate
- 7 Lock ring
- 8 Reverse gear selector
- 9 Stud shaft
- 10 5th gear wheel
- 11 Washer
- 12 Rear housing
- 13 Gasket
- 14 Bearing outer race
- 15 Roller bearing
- 16 Bearing inner race
- 17 Thrust washer
- 18 Bearing outer race
- 19 Bearing inner race
- 20 Shim, thicknesses:

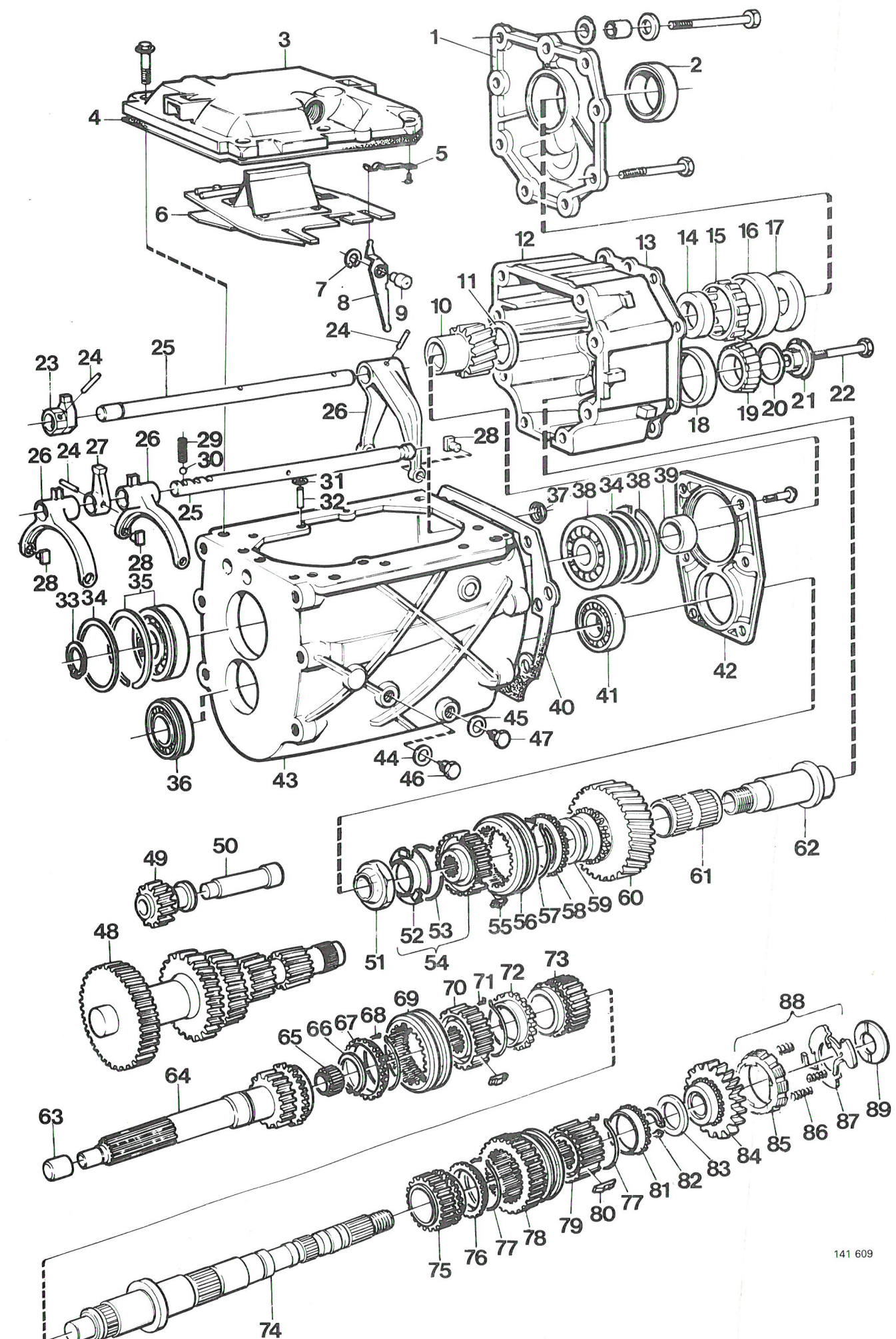
P/N	mm	in
3294334-2	0.10	0.004
3294335-9	0.15	0.006
3294336-7	0.25	0.010
3204069-3	0.55	0.022
3204070-1	0.75	0.030

- 21 Washer
- 22 Bolt
- 23 Gear selector
- 24 Pin
- 25 Selector shaft
- 26 Shift fork
- 27 Gear selector
- 28 Engaging lug
- 29 Spring
- 30 Interlocking ball
- 31 Washer
- 32 Guide pin
- 33 Lock ring
- 34 Shim, thicknesses:

P/N	mm	in
948008-8	0.60	0.024
948009-6	0.75	0.030
948010-4	0.90	0.036
948011-2	1.00	0.040

- 35 Ball bearing
- 36 Roller bearing
- 37 Seal
- 38 Ball bearing
- 39 Spacer

- 40 Gasket
- 41 Roller bearing
- 42 Bearing holder
- 43 Transmission housing
- 44 Gasket
- 45 Seal
- 46 Plug
- 47 Magnetic debris plug
- 48 Intermediate shaft
- 49 Reverse gear wheel
- 50 Stud shaft
- 51 Nut
- 52 Washer
- 53 Spring
- 54 Synchronizer ring
- 55 Sliding key ("dog")
- 56 Operating sleeve
- 57 Spring
- 58 Synchronizer ring
- 59 Washer
- 60 Gear wheel
- 61 Needle bearing
- 62 Shaft
- 63 Sleeve
- 64 Input shaft
- 65 Needle bearing
- 66 Lock ring
- 67 Synchronizer ring
- 68 Spring
- 69 Operating sleeve
- 70 Synchronizer hub
- 71 Spring
- 72 Synchronizer ring
- 73 3rd gear wheel
- 74 Main shaft
- 75 2nd gear wheel
- 76 Synchronizer ring
- 77 Spring
- 78 Operating sleeve
- 79 Synchronizer hub
- 80 Sliding key
- 81 Synchronizer ring
- 82 Lock ring
- 83 Washer
- 84 1st gear wheel
- 85 Brake cone
- 86 Spring
- 87 Drive flange
- 88 Damper
- 89 Thrust washer (if not equipped with damper)



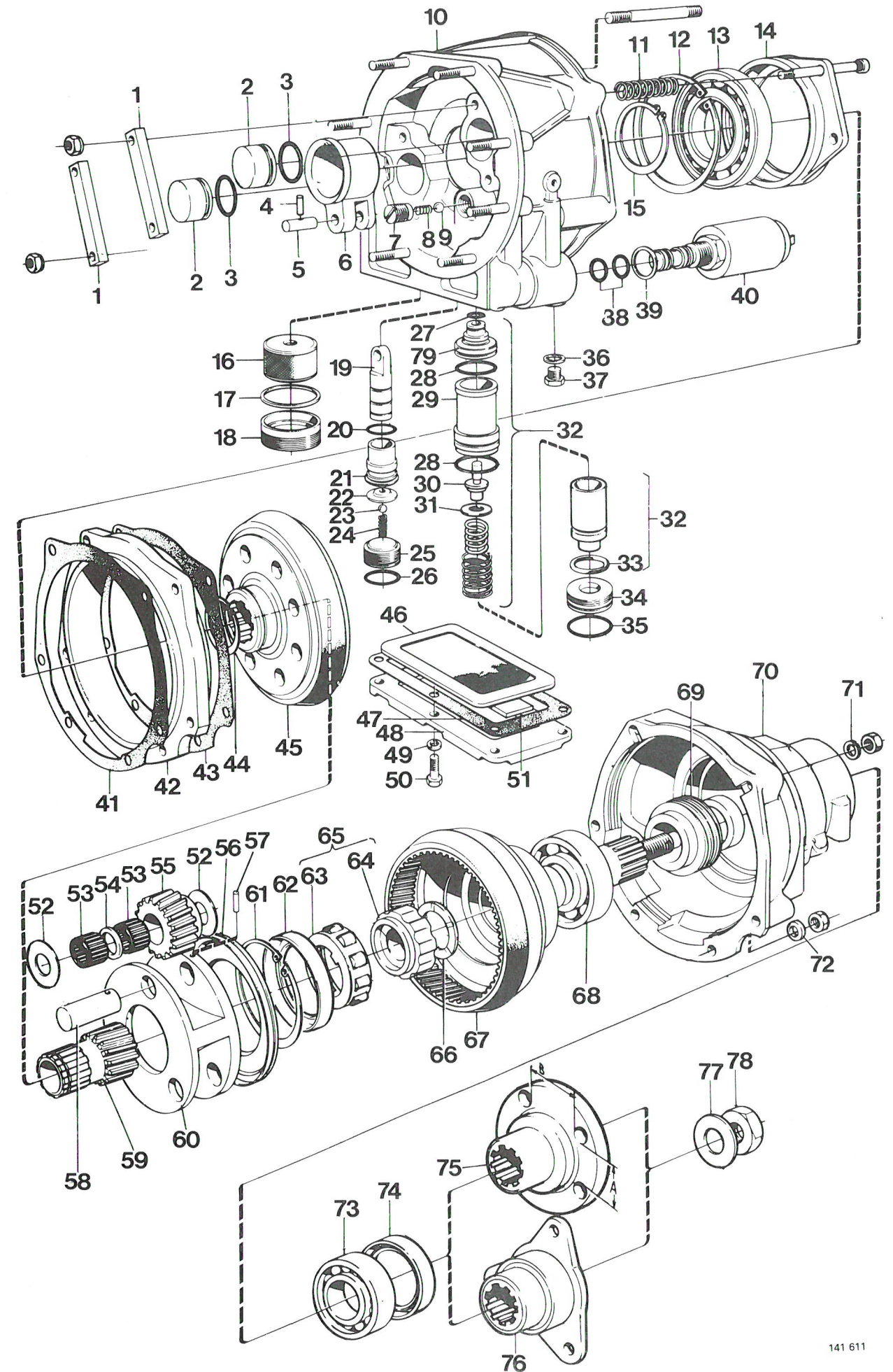
Type J Overdrive components

- 1 Bridge
- 2 Clutch piston
- 3 O-ring
- 4 Pin
- 5 Guide pin
- 6 Pump link
- 7 Relief valve
- 8 Spring
- 9 Ball
- 10 Front housing
- 11 Spring
- 12 Lock ring
- 13 Clutch bearing
- 14 Bearing holder
- 15 Lock ring
- 16 Oil filter
- 17 Washer
- 18 Plug
- 19 Pump piston
- 20 O-ring
- 21 Pump cylinder
- 22 Seat
- 23 Ball
- 24 Spring
- 25 Plug
- 26 O-ring
- 27 O-ring
- 28 O-ring
- 29 Cylinder
- 30 Piston
- 31 Pressure adjusting shim, thicknesses:

P/N	mm	in
1209450-4	0.05	0.0020
1209451-2	0.13	0.0052
1209452-0	0.25	0.0100
1209453-8	0.76	0.0300

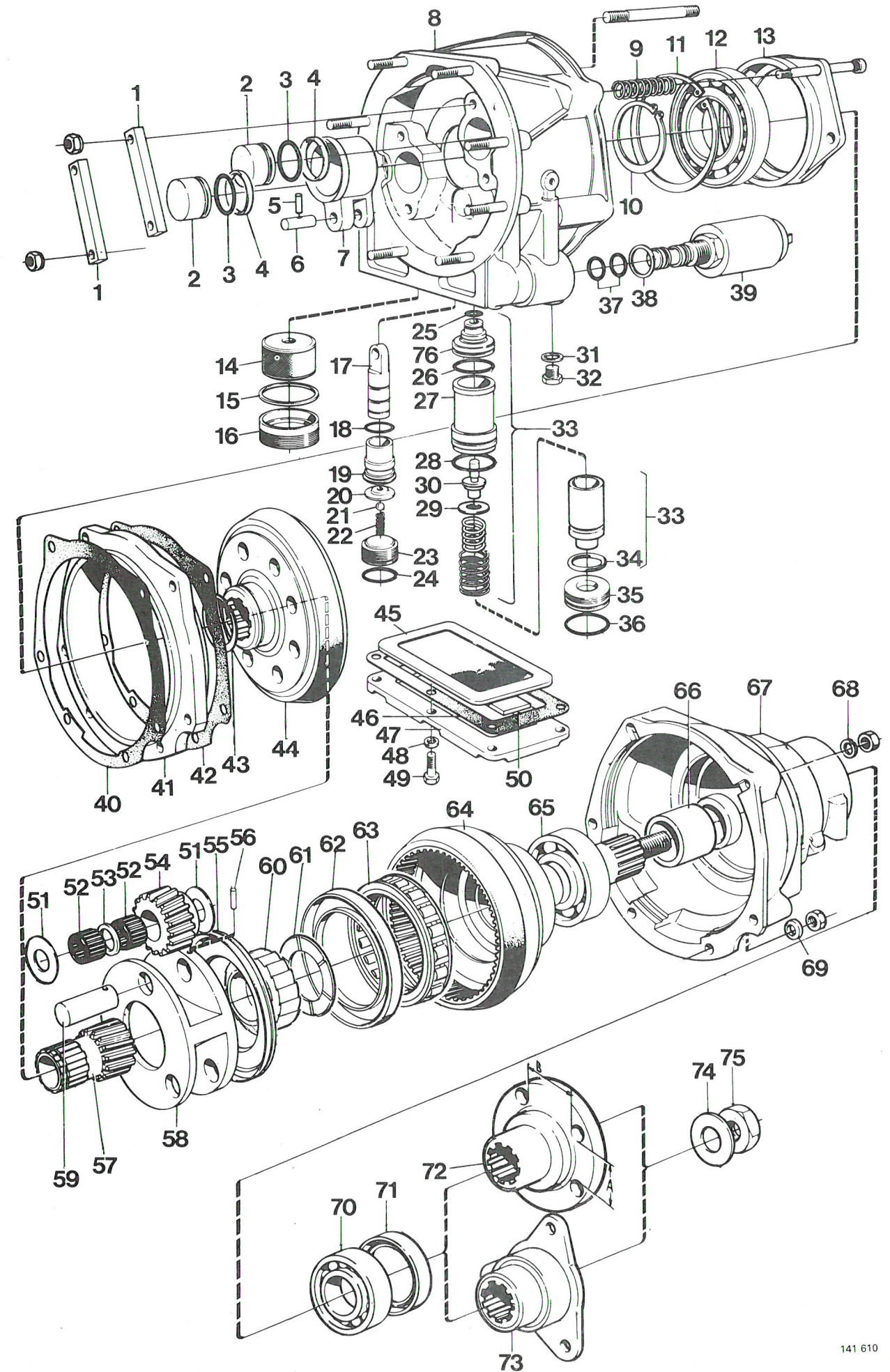
- 32 Relief valve assembly
- 33 O-ring
- 34 Plug
- 35 O-ring
- 36 Seal
- 37 Plug
- 38 O-ring
- 39 Seal
- 40 Solenoid valve
- 41 Gasket
- 42 Brake drum
- 43 Gasket
- 44 Lock ring
- 45 Clutch

- 46 Strainer
- 47 Gasket
- 48 Oil pan
- 49 Spring washer
- 50 Bolt
- 51 Debris magnet
- 52 Thrust washer
- 53 Needle bearing
- 54 Spacer washer
- 55 Planetary gear wheel
- 56 Oil slinger
- 57 Lock pin
- 58 Shaft
- 59 Sun gear
- 60 Planetary gear carrier
- 61 Lock ring
- 62 Race
- 63 Roller cage
- 64 One-way clutch hub
- 65 One-way clutch
- 66 Thrust washer
- 67 Output shaft
- 68 Ball bearing
- 69 Speedometer drive gear
- 70 Rear housing
- 71 Spring washer
- 72 Seal
- 73 Ball bearing
- 74 Seal
- 75 Drive flange, round
- 76 Drive flange, three-armed
- 77 Washer
- 78 Nut
- 79 Seat



Type P Overdrive components

- | | | |
|--|------------------------------|--------|
| 1 Bridge | 45 Strainer | |
| 2 Clutch piston | 46 Gasket | |
| 3 O-ring | 47 Oil pan | |
| 4 Teflon ring | 48 Spring washer | |
| 5 Pin | 49 Bolt | |
| 6 Guide pin | 50 Debris magnet | |
| 7 Pump link | 51 Thrust washer | |
| 8 Front housing | 52 Needle bearing | |
| 9 Spring | 53 Spacer | |
| 10 Lock ring | 54 Planetary gear wheel | |
| 11 Lock ring | 55 Oil slinger | |
| 12 Clutch bearing | 56 Locking pin | |
| 13 Bearing holder | 57 Sun gear | |
| 14 Oil filter | 58 Planetary gear carrier | |
| 15 Washer | 59 Shaft | |
| 16 Plug | 60 One-way clutch hub | |
| 17 Pump piston | 61 Thrust washer | |
| 18 O-ring | 62 Race | |
| 19 Cylinder | 63 Roller cage | |
| 20 Seat | 64 Output shaft | |
| 21 Ball | 65 Ball bearing | |
| 22 Spring | 66 Spacer | |
| 23 Plug | 67 Rear housing | |
| 24 O-ring | 68 Spring washer | |
| 25 O-ring | 69 Seal | |
| 26 O-ring | 70 Ball bearing | |
| 27 Cylinder | 71 Seal | |
| 28 Pressure adjusting shim, thicknesses: | 72 Drive flange, round | |
| P/N | mm | in |
| 1209450-4 | 0.05 | 0.0020 |
| 1209451-2 | 0.13 | 0.0052 |
| 1209452-0 | 0.25 | 0.0100 |
| 1209453-8 | 0.76 | 0.0300 |
| 30 Piston | 73 Drive flange, three-armed | |
| 31 Seal | 74 Washer | |
| 32 Plug | 75 Nut | |
| 33 Relief valve assembly | 76 Seat | |
| 34 O-ring | | |
| 35 Plug | | |
| 36 O-ring | | |
| 37 O-ring | | |
| 38 Seal | | |
| 39 Solenoid valve | | |
| 40 Gasket | | |
| 41 Brake drum | | |
| 42 Gasket | | |
| 43 Lock ring | | |
| 44 Clutch | | |



Index

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